Henry B. Hill,
Cambridge, Mass.

PROCEEDINGS

OF THE

AMERICAN ACADEMY

OF

ARTS AND SCIENCES.

VOL. I.

FROM MAY, 1846, TO MAY, 1848.

SELECTED FROM THE RECORDS.

BOSTON AND CAMBRIDGE:
METCALF AND COMPANY.
1848.

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Two hundred and eighty-fourth meeting.

May 26, 1846. — ANNUAL MEETING.

Dr. BIGELOW, Vice-President, in the chair.

The Treasurer made his Annual Report, which was referred to Mr. F. C. Lowell, as a committee to audit and examine. Mr. Lowell subsequently presented the audited Report, subjoined to the record.

Chief-Justice Shaw, referring to the loss which the Fellows of the Academy had recently sustained in the decease of their late distinguished President, spoke at some length of the many talents, accomplishments, and virtues of the late President, and expressed a strong hope that some proper public expression of respect for his memory might proceed from the Academy.

Mr. Everett followed with some eloquent and feeling remarks upon the character of the profound scholar, whose varied excellences had made him so widely known and so deeply regretted, and offered the following resolutions.

"Whereas, it has pleased Almighty God to remove from this life the Honorable John Pickering, late President of the American Academy of Arts and Sciences, —

"*Resolved*, That the Fellows of the Academy are deeply sensible

of the loss they have sustained, in the decease of their late honored President, whose eminent talents, various and exact learning, and wide-spread reputation, reflected the highest credit upon the literature of the United States, upon the numerous institutions of which he was a member, and especially upon the Academy over which he presided, with such credit to himself, and such advantage to his associates.

"*Resolved*, That, as members of the community, we lament the loss of a citizen of unblemished integrity and primitive simplicity of manners, who, by a long career of public service and private virtue, gave new lustre to an honored name.

"*Resolved*, That the Fellows of the Academy sincerely sympathize with the bereaved family of their lamented President, and that a copy of the resolutions be transmitted to them, in token of respectful condolence.

"*Resolved*, That a Eulogy on the late President be pronounced by a Fellow of the Academy, to be appointed for that purpose."

These resolutions having been unanimously adopted, the Hon. Daniel A. White was appointed to deliver a Eulogy upon the late President, at such time and place as he may select. It was also

Voted, That the Secretary be instructed to convey a copy of the resolutions to the family of the late President, and to cause them to be published in two or more newspapers.

The Corresponding Secretary read a communication announcing the death of Frederick William Bessell, the distinguished astronomer, one of the Foreign Honorary Members of the Academy.

Mr. Bowen, from the committee appointed at a former meeting to revise the By-laws, made a report, comprising a draught of the Statutes, as modified by various resolutions passed since the year 1834, which report, with several new resolves proposed by the committee, was accepted; and the Statutes, as revised and amended, were ordered to be printed, under the direction of the Committee on Publications, at the close of the current volume of the Memoirs of the Academy.

The Marquis of Northampton, President of the Royal Society, was chosen a Foreign Honorary Member of the Academy.

Henry J. Bigelow, M. D., of Boston, was chosen a Fellow of the Academy.

At the annual election, the following gentlemen were chosen officers for the ensuing year, namely: —

Jacob Bigelow, M. D., . . *President.*
Hon. Edward Everett, . *Vice-President.*
Prof. Asa Gray, ... *Corresponding Secretary.*
Oliver W. Holmes, M. D., *Recording Secretary.*
J. Ingersoll Bowditch, . *Treasurer.*
A. A. Gould, M. D., . . . *Librarian and Cabinet-Keeper.*

It having been voted that the several committees heretofore elected by ballot be named by the chair, the following gentlemen were accordingly appointed the members of the several standing committees.

Rumford Committee.

Daniel Treadwell, Benjamin Peirce,
John Ware, James Hayward,
F. C. Lowell.

Committee of Publications.

Amos Binney, Francis Bowen, Asa Gray.

Committee on the Library.

A. A. Gould, D. H. Storer, Benjamin Peirce.

The following donations to the library have been received since the 1st of January, 1846.

Lieutenant Gillis, U. S. N. Magnetical Observations made at the Naval Observatory, Washington. 8vo. 1845. (Congressional Document.) From Honorable R. C. Winthrop.

Alexander H. Everett. Miscellaneous Writings. 8vo. Boston, 1845. From the Author.

W. S. Sullivant. Musci Alleghanienses, sive Enumeratio Muscorum atque Hepaticarum quos in itinere a Marylandia usque ad Georgiam per tractus Montium. Decerpserunt Asa Gray et W. S. Sullivant. 8vo. Columbus, 1846. From the Author.

Report on Scientific Nomenclature made to the Association of Amer-

ican Geologists. 8vo. pamph. New Haven, 1846. From the Geological Association.

Dr. S. G. Morton. Memoir of William Maclure. 2d ed. 8vo. pamph. 1844. From the Author.

Transactions of the American Philosophical Society. Vol. IX., New Series, Part 2. 4to. Philadelphia, 1845. From the Society.

O. Rich. Bibliotheca Americana Nova. 8vo. London, 1846. From the Author.

Transactions of the Royal Irish Academy. Vol. XX. 4to. Dublin, 1845. From the Royal Irish Academy.

S. Swett. Sketches of Distinguished Men of Newbury and Newburyport. No. 1. (Captain Moses Brown.) 8vo. pamph. Boston, 1846. From the Author.

S. Borden. Tables of Bearings, &c., ascertained by the Trigonometrical Survey of Massachusetts. 8vo. pamph. Boston, 1846. From Mr. Borden.

Annuaire Magnétique et Meteorologique du Corps des Ingenieurs des Mines de Russie. No. 1. (2me Année, 1842.) 4to. St. Petersburgh, 1844. From the Imperial Academy of St. Petersburgh.

Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, in 1843. 4to. London, 1845. From the Royal Society.

Philosophical Transactions. Part 2, for 1845. From the Royal Society of London.

Astronomical Observations, made at the Observatory of Cambridge, by Rev. Charles James Challis. Vol. XIV., for 1842. 4to. Cambridge, 1845. From the Author.

Two hundred and eighty-fifth meeting.

August 12th, 1846. — Quarterly Meeting.

The President in the chair.

The Corresponding Secretary read a letter from the Marquis of Northampton, accepting and acknowledging with much courtesy his election as a Fellow of the Academy.

Professor Peirce read the following astronomical communications from William Cranch Bond, A. M., Director of the Cambridge Observatory.

1. Moon Culminations,

Observed at Cambridge Observatory, corrected for Collimation, Level, and Azimuthal Deviation of the Transit Instrument, and for Clock Rate and Error on Sidereal Time.

Lat. +42° 22′ 49″. Lon. West of Greenwich, 4 h. 44 m. 32 s.

Date.	Name of Object.	Sidereal time of meridian passage.	Seconds of Tabular A.R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1844, Oct. 20	γ Aquarii	21 01 09.32	09.44	+0.12	B[2]*
"	ζ Cygni	21 06 21.24	21.29	+0.05	"
"	β Aquarii	21 23 24.50	24.48	—0.02	"
"	ε Pegasi	21 36 35.34	35.29	—0.05	"
"	☽'s 1st Limb	21 50 47.92			"
"	ϑ Aquarii	22 08 40.28	39.91	—0.37	"
"	ζ Aquarii	22 20 52.28	51.90	—0.38	"
22	γ Aquilæ	19 38 53.50	53.58	+0.08	"
"	α Aquilæ	19 43 13.47	13.40	—0.07	"
"	β Aquilæ	19 47 42.15	42.14	—0.01	"
"	β Piscium	22 51 00.63	00.58	—0.05	"
"	γ Piscium	23 09 09.15	09.07	—0.08	"
"	☽'s 1st Limb	23 29 55.62			"
"	ω Piscium	23 51 22 99	22.55	—0.44	"
23	☽'s 1st Limb	0 18 20.63			"
"	β Ceti	0 35 49.60	49.79	+0.19	"
"	δ Piscium	0 40 39.99	40.24	+0.25	"
Nov. 16	γ Aquarii	21 01 09.26	09.03	—0.23	"
"	β Aquarii	21 23 24.05	24.08	+0.03	"
"	☽'s 1st Limb	21 34 15.44			"
"	30 Aquarii	21 55 07.72	07.42	—0.30	"
"	α Cephei	21 14 52.72	52.66	—0.06	"
19	$\varkappa^2$ Piscium	23 31 59.76	59.71	—0.05	B[1]
"	γ Pegasi	0 05 17.26	16.92	—0.34	"
"	☽'s 1st Limb	0 03 07.76			"
"	d Piscium	0 12 38.95	38.95	0.00	"
"	α Cassiopeæ	0 31 47.10	47.24	+0.14	"
"	β Ceti	0 35 49.51	49.63	+0.12	"
Dec. 16	γ Piscium	23 09 08.64	08.46	—0.18	B[2]
"	$\varkappa^1$ Piscium	23 19 00.02	59.97	—0.05	"
"	☽'s 1st Limb	23 47 00.28			"
"	Arcturus	14 08 35.43	35.43	0.00	"
17	Arcturus	14 08 35.46	35.46	0.00	"
"	ω Piscium	23 51 22.20	22.04	—0.16	"
"	☽'s 1st Limb	0 35 35.26			"
18	α Andromedæ	0 00 24.35	24.24	—0.11	B[1]
"	γ Pegasi	0 05 16.51	16.61	+0.10	"

* B[1] is the initial of *William C. Bond;* B[2], that of *George P. Bond.*

Date.	Name of Object.	Sidereal time of meridian passage. h. m. s.	Seconds of Tabular A.R. s.	Diff. s.	Observer's initial.
1844, Dec. 18	58 Piscium	0 38 57.82	56.93	—0.89	B^1
"	s Piscium	0 54 55.32	55.61	+0.29	"
"	☽'s 1st Limb	1 24 09.92			"
"	π Piscium	1 28 54.68	54.86	+0.18	"
"	β Arietis	1 46 06.65	06.93	+0.28	"
20	α Cassiopeæ	0 31 46.53	46.55	+0.02	B^2
"	β Ceti	0 35 49.27	49.29	+0.02	"
"	58 Piscium	0 38 57.84	56.91	—0.93	"
"	ψ Arietis	2 22 20.74	20.56	—0.18	"
"	☽'s 1st Limb	3 03 42.34			"
"	ζ Arietis	3 06 02.02	02.27	+0.25	"
"	g Arietis	3 15 11.94	11.97	+0.03	"
1845, Jan. 12	☽'s 1st Limb	23 27 14.81			B^1
"	α Andromedæ	0 00 24.05	23.91	—0.14	"
"	γ Pegasi	0 05 16.13	16.33	+0.20	"
18	η Tauri	3 38 19.08	18.90	+0.18	B^2
"	A^1 Tauri	3 55 34.56	34.38	—0.18	"
"	γ^1 Eridani	3 50 49.62	49.67	+0.05	"
"	☽'s 1st Limb	4 29 05.21			"
"	τ Tauri	4 32 59.20	59.18	—0.02	"
"	ι Tauri	4 53 52.47	52.48	+0.01	"
"	β Orionis	5 07 07.28	07.60	+0.32	"
19	τ Tauri	4 32 59.08	59.17	+0.09	B^1
"	☽'s 1st Limb	5 21 37.91			"
"	δ Orionis	5 24 07.65	07.60	—0.05	"
"	ζ Tauri	5 28 25.68	25.51	—0.17	"
"	c Tauri	5 43 37.98	37.90	—0.08	"
"	α Orionis	5 46 49.27	49.32	+0.05	"
March 16	χ^5 Orionis	5 54 44.80	44.79	—0.01	B^2
"	☽'s 1st Limb	6 24 38.95			"
"	γ Geminorum	6 28 47.41	47.30	—0.11	"
"	ζ Geminorum	6 54 56.85	57.02	+0.17	"
19	☽'s 1st Limb	8 57 34.88			"
"	κ Cancri	8 59 23.12	23.29	+0.17	"
21	π Leonis	9 52 04.12	03.88	—0.24	B^1
"	α Leonis	10 00 09.62	09.53	—0.09	"
"	☽'s 1st Limb	10 38 11.30			"
"	d Leonis	10 52 35.87	36.06	+0.19	"
"	p^4 Leonis	11 05 51.94	52.17	+0.23	"
"	δ Hyd. et Crat.	11 11 38.36	38.57	+0.21	"
April 15	☽'s 1st Limb	8 35 34.62			B^2
"	α^2 Cancri	8 50 02.57	02.35	—0.22	"
May 14	☽'s 1st Limb	9 53 12.26			"
"	α Leonis	10 00 08.87	08.88	+0.01	"
"	δ Leonis	11 05 53.72	53.75	+0.03	"
"	δ Hyd. et Crat.	11 11 38.18	38.19	+0.01	"
21	η Bootis	13 47 21.27	21.16	—0.11	B^1

Date.	Name of Object.	Sidereal time of meridian passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1845, May 21	ε Bootis	14 38 15.96	16.02	+ 0.06	B[1]
"	α^2 Libræ	14 42 22.29	22.33	+ 0.04	"
"	β Libræ	15 08 43.73	43.80	+ 0.07	"
"	α Cor. Borealis	15 28 10.51	10.55	+ 0.04	"
"	λ Libræ	15 44 24.45	24.41	— 0.04	"
"	β^1 Scorpii	15 56 29.74	29.65	— 0.09	"
"	ω Ophiuchi	16 23 01.35	01.14	— 0.21	"
"	☽'s 1st Limb	16 27 19.24			"
"	☽'s 2d Limb	16 29 47.53			"
"	m Scorpii	16 32 41 02	40.60	— 0.42	"
June 17	ι Libræ	15 03 27.29	27.52	+ 0.23	B[2]
"	γ Libræ	15 21 55.32	55.43	+ 0.11	"
"	☽'s 1st Limb	15 52 35.65			"
"	β^1 Scorpii	15 56 29.75	29.82	+ 0.07	"
"	α Serpentis	15 36 41.73	41.43	— 0.30	"
July 15	α Serpentis	15 36 41.19	41.41	+ 0.22	B[1]
"	β^1 Scorpii	15 56 29.91	29.83	— 0.08	"
"	δ Ophiuchi	16 06 17.22	17.17	— 0.05	"
"	Antares	16 19 59.07	58.95	— 0.12	"
"	☽'s 1st Limb	16 26 09.49			"
17	☽'s 1st Limb	18 39 33.49			B[2]
"	π Sagittarii	19 00 37.02	37.05	+ 0.03	"
"	ϱ^1 Sagittarii	19 12 45.40	45.23	— 0.17	"
Sept. 8	α Scorpii	16 19 58.24	58.16	— 0.08	B[1]
"	☽'s 1st Limb	16 42 50.74			"
"	η Ophiuchi	17 01 33.00	32.92	— 0.08	"
"	α Herculis	17 07 37.60	37.54	— 0.06	"
10	α Scorpii	16 19 57.96	58.12	+ 0.16	"
"	η Ophiuchi	17 01 32.87	32.88	+ 0.01	"
"	α Herculis	17 07 37.62	37.50	— 0.12	"
"	β Draconis	17 26 57.44	57.53	+ 0.09	"
"	4 Sagittarii	17 50 23.60	23.55	— 0.05	"
"	μ^1 Sagittarii	18 04 33.79	33.47	— 0.32	"
"	☽'s 1st Limb	18 48 12.29			"
"	o Sagittarii	18 55 27.38	27.56	+ 0.18	"
"	ϱ^1 Sagittarii	19 12 44.74	44.96	+ 0.22	"
11	α Herculis	17 07 37.72	37.48	— 0.24	B[2]
"	o Sagittarii	18 55 27.59	27.54	— 0.05	"
"	π Sagittarii	19 00 36.60	36.76	+ 0.16	"
"	ϱ^1 Sagittarii	19 12 44.67	44.94	+ 0.27	"
"	e^2 Sagittarii	19 33 43.01	43.04	+ 0.03	"
"	☽'s 1st Limb	19 50 12.19			"
"	α^2 Capricorni	20 09 30.94	31.05	+ 0.11	"
"	ϱ Capricorni	20 20 04.93	05.08	+ 0.15	"
12	α^2 Capricorni	20 09 31.00	31.04	+ 0.04	"
"	ϱ Capricorni	20 20 05.04	05.07	+ 0.03	"
"	☽'s 1st Limb	20 50 31.08			"

Date.	Name of Object.	Sidereal time of meridian passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1845, Sept. 12	ν Aquarii	21	01	12.77	12.98	+0.21	B^2
15	β Piscium	22	56	03.62	03.62	0.00	"
"	γ Piscium	23	09	12.02	12.13	+0.11	"
"	ι Piscium	23	32	02.98	02.94	—0.04	"
"	☽'s 1st Limb	23	40	33.42			"
"	☽'s 2d Limb	23	42	47.76			"
"	E^1 Piscium	0	02	08.99			"
"	B Piscium	0	07	04.52			"
"	*d* Piscium	0	12	41.80	41.92	+0.12	"
16	ι Piscium	23	32	02.85	02.94	+0.09	B^1
"	ω Piscium	23	51	25.23	25.42	+0.19	"
"	γ Pegasi	0	05	20.13	19.99	—0.14	"
"	*d* Piscium	0	12	41.57	41.92	+0.35	"
"	☽'s 2d Limb	0	37	04.89			"
"	δ Piscium	0	40	42.67	42.97	+0.30	"
"	ϵ Piscium	0	54	58.57	58.61	+0.04	"
17	δ Piscium	0	40	43.00	42.98	—0.02	B^2
"	☽'s 2d Limb	1	30	01.54			"
"	o Piscium	1	37	17.62			"
"	β Arietis	1	46	10.03	09.70	—0.33	"
22	δ Orionis	5	24	08.42	08.58	+0.16	B^1
"	ζ Tauri	5	28	26.88	26.72	—0.16	"
"	α Orionis	5	46	50.14	50.22	+0.08	"
"	☽'s 2d Limb	5	58	27.67			"
"	μ Geminorum	6	13	38.69	38.47	—0.22	"
"	γ Geminorum	6	28	48.63	48.55	—0.08	"
24	μ Geminorum	6	13	38.56	38.55	—0.01	"
"	γ Geminorum	6	28	48.70	48.61	—0.09	"
"	☽'s 2d Limb	7	40	41.52			"
Oct. 13	κ^1 Piscium	23	19	03.20	03.49	+0.29	B^2
"	ι Piscium	23	32	02.99	02.99	0.00	"
"	ω Piscium	23	51	25.53	25.53	0.00	"
"	E^1 Piscium	0	02	09.42			"
"	B Piscium	0	07	04.60			"
"	☽'s 1st Limb	0	10	44.60			"
"	δ Piscium	0	40	43.30	43.15	—0.15	"
14	☽'s 1st Limb	1	04	17.51			B^1
"	☽'s 2d Limb	1	06	29.59			"
"	α Andromedæ	0	00	28.04	27.86	—0.18	"
"	γ Pegasi	0	05	19.93	20.08	+0.15	"
"	*d* Piscium	0	12	41.96	42.04	+0.08	"
"	η Piscium	1	23	16.66	16 54	—0.12	"
"	o Piscium	1	37	17.42	17.31	—0.11	"
17	δ Arietis	3	02	51.58	51.17	—0.41	B^2
"	ζ Arietis	3	05	05.12			"
"	☽'s 2d Limb	3	48	47.00			"
"	γ Tauri	4	11	03.51	03.14	—0.37	"

Date.	Name of Object.	Sidereal time of meridian passage. h.	m.	s.	Seconds of Tabular A.R s.	Diff. s.	Observer's initial.
1845, Oct. 17	δ Tauri	4	14	04.95			B^2
21	ζ Geminorum	6	54	59.04	58.91	—0.13	"
"	51 Geminorum	7	04	32.28			"
"	δ Geminorum	7	10	55.79	55.71	—0.08	"
"	☽'s 2d Limb	7	19	50.06			"
"	κ Geminorum	7	24	49.58	49.19	—0.39	"
"	g Geminorum	7	37	12.64	12.55	—0.09	"
22	ζ Cancri	8	03	32.88			"
"	☽'s 2d Limb	8	09	35.73			"
"	ϑ Cancri	8	22	48.76	48.57	—0.19	"
"	δ Cancri	8	35	55.77	55.53	—0.24	"
23	α^2 Cancri	8	50	03.36	03.38	+0.02	"
"	☽'s 2d Limb	8	58	18.36			"
Nov. 5	☽'s 1st Limb	20	12	08.00			"
"	ρ Capricorni	20	20	04.48			"
"	ε Aquarii	20	39	20.20	20.25	+0.05	"
7	β Aquarii	21	23	27.18	27.15	—0.03	"
"	ξ Aquarii	21	29	33.26	33.16	—0.10	"
"	λ Capricorni	21	38	14.68	14.92	+0.24	"
"	☽'s 1st Limb	22	05	22.86			"
"	γ Aquarii	22	13	42.36	42.47	+0.11	"
10	E^1 Piscium	0	03	09.16	08.09	—1.07	"
"	B Piscium	0	07	04.58			"
"	d Piscium	0	12	42.00	41.92	—0.08	"
"	☽'s 1st Limb	0	44	04.68			"
12	β Arietis	1	46	10.20	10.21	+0.01	B^1
"	α Arietis	1	58	31.94	31.88	—0.06	"
"	☽'s 1st Limb	2	30	02.58			"
"	π Arietis	2	40	44.18	44.24	+0.06	"
14	η Tauri	3	38	22.28	22.26	—0.02	B^2
"	A^1 Tauri	3	55	37.77	37.61	—0.16	"
"	☽'s 2d Limb	4	20	23.66			"
"	α Tauri	4	27	07.07	07.12	+0.05	"
"	ι Tauri	4	53	55.44	55.38	—0.06	"
16	ζ Tauri	5	28	28.16	28.23	+0.07	"
"	χ^1 Orionis	5	45	17.42	17.75	+0.33	"
"	☽'s 2d Limb	6	07	29.48			"
"	χ^5 Orionis	5	54	47.88	48.03	+0.15	"
"	γ Geminorum	6	28	50.16	50.16	0.00	"
19	ζ Cancri	8	03	23.73	23.16	—0.57	"
"	ϑ Cancri	8	21	49.55			"
"	☽'s 2d Limb	8	38	27.86			"
"	κ Cancri	8	59	24.47	24.67	+0.20	"
21	☽'s 2d Limb	10	13	36.70			"
"	ρ Leonis	10	24	41.68	42.13	+0.45	"
"	48 Leonis	10	26	55.98			"
"	34 Sextantis	10	34	39.72	38.99	—0.73	"

Date.	Name of Object.	Sidereal time of meridian passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1845, Dec. 5	α Aquarii	21	57	52.30	52.45	+0.15	B^1
"	ϑ Aquarii	22	08	42.06	42.24	+0.18	"
"	ζ Aquarii	22	20	54.02	54.19	+0.17	"
"	☽'s 2d Limb	22	43	01.42			"
"	γ Piscium	23	09	11.12	11.50	+0.38	"
"	γ Pegasi	0	05	19.68	19.69	+0.01	"
6	β Aquarii	22	56	02.84	02.91	+0.07	B^2
"	γ Piscium	23	09	11.44	11.49	+0.05	"
"	☽'s 1st Limb	23	36	02.28			"
"	ω Piscium	23	51	25.22	25.03	—0.19	"
9	η Piscium	1	23	16.42	16.46	+0.04	B^1
"	β Arietis	1	46	10.04	10.12	+0.08	"
"	α Arietis	1	58	31.71	31.90	+0.19	"
"	☽'s 2d Limb	2	12	11.26			"
"	ψ Arietis	2	22	24.22	23.75	—0.47	"
"	π Arietis	2	40	44.55	44.28	—0.27	"
10	α Arietis	1	58	31.80	31.89	+0.09	"
"	ψ Arietis	2	22	24.02	23.75	—0.27	"
"	π Arietis	2	40	44.26	44.28	+0.02	"
"	☽'s 1st Limb	3	05	04.18			"
"	η Tauri	3	38	22.50	22.46	—0.04	"
11	ζ Arietis	3	06	05.82	05.53	—0.29	"
"	η Tauri	3	38	22.30	22.46	+0.16	"
"	☽'s 1st Limb	3	58	32.58			"
"	α Tauri	4	27	06.72	07.43	+0.71	"
12	δ^1 Tauri	4	14	05.48	05.48	0.00	B^2
"	ε Tauri	4	19	39.73	39.73	0.00	"
"	α Tauri	4	27	07.32	07.44	+0.12	"
"	☽'s 1st Limb	4	52	14.32			"
"	ο Tauri	5	18	25.43	25.39	—0.04	"
13	α Arietis	1	58	31.76	31.87	+0.11	B^1
"	α Tauri	4	27	07.69	07.45	—0.24	"
"	β Tauri	5	16	35.95	35.95	0.00	"
"	☽'s 1st Limb	5	45	34.52			"
"	☽'s 2d Limb	5	47	45.45			"
16	☽'s 2d Limb	8	20	33.62			B^2
"	δ Cancri	8	35	57.20	57.23	+0.03	"
"	α^2 Cancri	8	50	05.04	05.04	0.00	"
"	κ Cancri	8	59	25.60	25.53	—0.07	"
21	☽'s 2d Limb	12	18	06.52			"
"	γ^1 Virginis	12	33	51.94	51.83	—0.11	"
"	ψ Virginis	12	46	21.71	21.62	—0.09	"
23	γ^1 Virginis	12	33	51.86	51.86	0.00	"
"	ψ Virginis	12	46	21.30	21.66	+0.36	"
"	☽'s 2d Limb	13	08	51.28			"
"	Spica	13	17	05.63	05.58	—0.05	"
"	m Virginis	13	33	32.55	32.64	+0.09	"

Date.		Name of Object.	Sidereal time of meridian passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
			h.	m.	s.	s.	s.	
1846, Jan.	3	E^1 Piscium	0	02	08.36			B^2
	"	γ Pegasi	0	05	19.59	19.39	—0.20	"
	"	☽'s 1st Limb	0	11	18.79			"
	"	d Piscium	0	12	41.22	41.35	+0.13	"
	"	α Cassiopeæ	0	31	49.70	49.67	—0.03	"
	"	β Ceti	0	35	51.90	51.87	—0.03	"
	"	δ Piscium	0	40	42.65	52.59	—0.06	"
	5	η Piscium	1	23	16.33	16.17	—0.16	"
	"	☽'s 1st Limb	1	56	21.73			"
	"	α Arietis	1	58	31.58	31.63	+0.05	"
	"	ϑ^1 Arietis	2	09	35.69	35.69	0.00	"
	6	α Arietis	1	58	31.71	31.62	—0.09	"
	"	☽'s 1st Limb	2	48	54.22			"
	"	ε Arietis	2	50	26.76	26.68	—0.08	"
	"	α Ceti	2	54	15.39	15.57	+0.18	"
	9	ι Tauri	4	53	55.87	55.88	+0.01	"
	"	ψ^2 Orionis	5	00	55.40	55.32	—0.08	"
	"	β Orionis	5	07	10.38	10.33	—0.05	"
	"	☽'s 1st Limb	5	27	59.50			"
	"	χ^1 Orionis	5	45	18.38	18.47	+0.09	"
	13	ϑ Cancri	8	22	50.97	50.85	—0.12	"
	"	δ Cancri	8	35	57.95	57.85	—0.10	"
	"	ε Hydræ	8	38	39.15	39.33	+0.18	"
	"	☽'s 2d Limb	8	48	40.66			"
	"	κ Cancri	8	59	26.26	26.17	—0.09	"
	"	ξ Leonis	9	23	40.41	40.61	+0.20	"
	14	δ Cancri	8	35	57.82	57.85	+0.03	B^1
	"	ε Hydræ	8	38	39.36	39.34	—0.02	"
	"	ξ Leonis	9	23	40.67	40.61	—0.06	"
	"	☽'s 2d Limb	9	40	11.13			"
Feb.	4	η Tauri	3	38	21.94	22.02	+0.08	"
	"	λ Tauri	3	52	10.98	10.77	—0.21	"
	"	☽'s 1st Limb	4	17	58.20			"
	5	☽'s 1st Limb	5	10	59.30			"
	"	β Tauri	5	16	35.90	35.89	—0.01	"
	"	ζ Tauri	5	28	28.56	28.69	+0.13	"
	"	B Tauri	5	39	36.52			"
	6	γ Geminorum	6	28	50.86	51.05	+0.19	B^2
	"	o Tauri	5	18	25 46	25.34	—0.12	"
	"	ζ Tauri	5	28	28.70	28.68	—0.02	"
	"	☽'s 1st Limb	6	08	28.98			"
	9	α^2 Geminorum	7	24	48.58	48.72	+0.14	B^1
	"	29 Cancri	8	20	03.96	03.54	—0.42	"
	"	ϑ Cancri	8	21	50.76			"
	"	☽'s 1st Limb	8	34	37.02			"
	"	ε Hydræ	8	38	39.52	39.57	+0.05	"
	"	α^2 Cancri	8	50	06.19	05.96	—0.23	"

Date.	Name of Object.	Sidereal time of meridian passage.	Seconds of Tabular A.R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1846, Feb. 9	$\varkappa$ Cancri	8 59 26.40			B[1]
12	o^1 Sextantis	10 38 06.70	06.73	+0.03	B[2]
"	☽'s 2d Limb	10 59 03.60			"
"	σ Leonis	11 13 14.10	14.03	—0.07	"
"	τ Leonis	11 20 03.36	03.34	—0.02	"
March 9	δ Cancri	8 35 58.20	57.97	—0.23	B[1]
"	α^2 Cancri	8 50 06.16	05.86	—0.30	"
"	☽'s 1st Limb	9 05 47.51			"
"	ξ Leonis	9 23 41.17	40.97	—0.20	"
"	o Leonis	9 32 58.14	58.22	+0.08	"
11	α Leonis	10 00 12.80	12.53	—0.27	"
"	ϱ Leonis	10 24 44.41	44.43	+0.02	"
"	☽'s 1st Limb	10 40 47.87			"
"	α Leonis	10 52 38.74	38.92	+0.18	"
"	σ Leonis	11 13 14.02	14.29	+0.27	"
April 7	☽'s 1st Limb	10 22 12.70			"
"	α Leonis	10 00 12.04	12.31	+0.27	"
"	ϱ Leonis	10 24 44.40	44.27	—0.13	"
6	α^2 Geminorum	7 24 47.99	47.83	—0.16	"
"	β Geminorum	7 35 54.92	54.92	0.00	"
"	α^2 Cancri	8 20 05.55	05.50	—0.05	"
"	$\varkappa$ Cancri	8 59 26.12	26.03	—0.09	"
"	o Leonis	9 32 57.73	57.95	+0.22	"
"	☽'s 1st Limb	9 34 51.77			"
"	α Leonis	10 00 12.06	12.32	+0.26	"
9	β Virginis	11 42 43.01	43.21	+0.20	"
"	☽'s 1st Limb	11 58 02.33			"
"	η Virginis	12 12 04.40	04.27	—0.13	"
"	γ^1 Virginis	12 33 54.06	53.97	—0.09	"
10	δ Hydræ	11 11 41.35	41.30	—0.05	"
"	γ^1 Virginis	12 33 54.12	53.98	—0.14	"
"	☽'s 1st Limb	12 45 49.10			"
"	α Virginis	13 17 07.60	08.04	+0.44	"
11	δ Hydræ	11 11 41.38	41.31	—0.07	"
"	α Virginis	13 17 07.96	08.08	+0.12	"
"	ϑ Virginis	13 02 01.51	01.82	+0.31	"
"	☽'s 2d Limb	13 41 50.02			"
"	$\varkappa$ Virginis	14 04 44.22			"
"	λ Virginis	14 10 50.10	50.22	+0.12	"
16	μ^1 Sagittarii	18 04 35.55	35.65	+0.10	"
"	☽'s 2d Limb	18 34 29.21			"
"	π Sagittarii	19 00 38.57	38.25	—0.32	"
17	β Lyræ	18 44 25.10	25.32	+0.22	"
"	o Sagittarii	18 55 29.34	29.19	—0.15	"
"	π Sagittarii	19 00 38.33	38.29	—0.04	"
"	δ Aquilæ	19 17 45.50	45.57	+0.07	"
"	☽'s 2d Limb	19 35 11.12			"

Date.	Name of Object.	Sidereal time of meridian passage.			Seconds of Tabular A.R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1846, May 4	α Leonis	10	00	11.98	11.96	— 0.02	B²
"	☽'s 1st Limb	10	02	34.77			"
"	ϱ Leonis	10	24	44.04	43.96	— 0.08	"
12	m Scorpii	16	32	43.69	43.75	+ 0.06	"
"	☽'s 2d Limb	17	11	18.40			"
"	α Ophiuchi	17	27	50.23	49.91	— 0.32	"
"	o Ophiuchi	17	34	15.63	15.61	— 0.02	"
13	α Ophiuchi	17	27	50.23	49.93	— 0.30	B¹
"	o Ophiuchi	17	34	15.55	15.63	+ 0.08	"
"	μ^1 Sagittarii	18	04	36.32	36.38	+ 0.06	"
"	☽'s 2d Limb	18	14	01.75			"
"	ξ Sagittarii	18	48	35.16			"
"	ϱ^1 Sagittarii	19	12	47.11	47.15	+ 0.04	"
"	e^2 Sagittarii	19	33	45.10	45.04	— 0.06	"
June 5	Spica	13	17	08.01	08.01	0.00	"
"	☽'s 1st Limb	13	45	33.63			"
"	κ Virginis	14	04	44.18	44.25	+ 0.07	"
6	κ Virginis	14	04	44.25	44.35	+ 0.10	B²
"	λ Virginis	14	10	50.37	50.41	+ 0.04	"
"	☽'s 1st Limb	14	40	32.82			"
"	α^2 Libræ	14	42	25.41	25.41	0.00	"
"	β Libræ	15	08	46.93	46.83	— 0.10	"
8	δ Scorpii	15	51	17.73	17.88	+ 0.15	"
"	β^1 Scorpii	15	56	33.12	33.01	— 0.11	"
"	δ Ophiuchi	16	06	19.82	20.11	+ 0.29	"
"	α Scorpii	16	20	02.29	02.31	+ 0.02	"
"	☽'s 1st Limb	11	40	42.17			"
"	η Ophiuchi	17	01	36.68	36.60	— 0.08	"
"	α Herculis	17	07	40.73	40.70	— 0.03	"
"	ϑ Ophiuchi	17	12	37.29	37.16	— 0.13	"
9	β Libræ	15	08	46.74	46.82	— 0.08	B¹
"	η Ophiuchi	17	01	36.62	36.61	— 0.01	"
"	ϑ Ophiuchi	17	12	37.20	37.17	— 0.03	"
"	☽'s 2d Limb	17	46	56.07			"
"	μ^1 Sagittarii	18	04	36.97	36.94	— 0.03	"
"	λ Sagittarii	18	18	31.75	31.80	+ 0.05	"
10	μ^1 Sagittarii	18	04	37.04	36.98	— 0.06	B²
"	λ Sagittarii	18	18	31.69	31.82	— 0.13	"
"	☽'s 2d Limb	18	51	17.28			"
"	o Sagittarii	18	55	30.72	30.67	— 0.05	"
"	π Sagittarii	19	00	39.68	39.78	— 0.10	"
14	β Aquarii	21	23	29.89	29.61	— 0.28	"
"	ε Pegasi	21	30	40.12	40.00	— 0.12	"
"	α Aquarii	21	57	54.81	54.88	+ 0.07	"
"	☽'s 2d Limb	22	51	36.73			"

The instrument used in these observations was a 46-inch Transit, made by Troughton and Simms; 2¾-inch object-glass.

2. Transit of Mercury, May 8th, 1845.

"The first and second contacts of the planet with the sun's limb were lost by clouds.

"Mercury was first seen on the disk of the sun at $2^{h.}\ 48^{m.}\ 31^{s.}$ sidereal time. Observations for the relative positions of the planet and the sun were immediately commenced, and were continued throughout the transit, though frequently interrupted by the passage of cumulus clouds, which prevailed through the day.

"The tremulous state of the atmosphere towards the close of the observations was unfavorable to the accuracy of the measurements.

"It was thought, at one time, that a luminous spot was visible near the centre of the disk of the planet; any decisive evidence of its existence was precluded by the limited power of the instrument.

"At the last contact, the singular phenomenon of the inosculation of the adjacent edges of the planet and sun was distinctly noticed by both observers. The present instance is one of much interest, as it has hitherto been supposed that Mercury is not thus affected when in close proximity to the sun's limb, although this sort of phenomenon has frequently been noticed in the transits of Venus (see *Mem. Royal Ast. Soc.*, Vol. X.).

"The third and fourth contacts were pretty well observed, but owing to the oblique and slow motion of the planet across the sun, combined with the unsettled state of the atmosphere, we were unable to note the times of contact with sufficient accuracy to be of much value for the purposes of terrestrial longitude. The times noted were as follows: —

	h. m. s.		
Third contact,	9 09 00	Observer,	W. C. Bond.
"	9 08 58	"	Geo. P. Bond.
Last or fourth contact,	9 12 09	"	W. C. Bond.
" "	9 12 00	"	Geo. P. Bond.

"In the following observations, B^1 denotes W. C. Bond.
B^2 " Geo. P. Bond.
W " Captain Wilkes, U.S.N.
P " Professor Peirce.

"*Micrometric Measurements of the Differences of Right Ascension of Mercury and the Sun's Limb, corrected for Refraction, and also for the Sun's Motion in the Intervals of Transit.*

The telescope used was a Refractor of 2¾-inch aperture and 46 inches focus, furnished with Troughton's spider-line micrometer.

Sidereal time of the passage of Mercury.	Diff. of A. R. of Mercury and Sun's 1st Limb.	Observed relative motion in A. R.	Computed relative motion in A. R.	Diff.	Diff. of A. R. of Mercury and Sun's 2d Limb.	Observed relative motion in A. R.	Computed relative motion in A. R.	Diff.	Observed by.	Recorded by.
h. m. s.	.	s.	s.		s.	s.	s.			
2 52 29.6					1.5				B¹	B¹
54 40.9					2.2	+0.7	+0.5	−0.2	"	"
56 31.1					4.0	1.8	0.5	−1.3	"	"
4 02 24.7					*21.0	17.0	16.5	−0.5	"	W
08 55.7					21.6	0.6	1.6	+1.0	"	"
12 38.2					23.1	1.5	0.9	−0.6	"	"
16 23.7	109.7				23.6	0.5	0.9	+0.4	"	"
29 36.2					26.5	2.9	3.3	+0.4	"	"
32 09.2	106.2	+3.5	+3.9	+0.4					"	"
48 02.7					32.1	5.6	4.6	−1.0	"	"
50 38.2	100.7	5.5	4.6	−0.9	32.6	0.5	0.6	+0.1	"	"
5 07 11.7	97.3	3.4	4.1	+0.7	36.1	3.5	4.1	+0.6	"	"
24 57.2	92.2	5.1	4.4	−0.7	†38.6	2.5	4.4	+1.9	"	"
29 51.2	91.2	1.0	1.2	+0.2	42.1	3.5	1.2	−2.3	"	"
32 35.7	90.7	0.5	0.7	−0.2	43.1	1.0	0.7	−0.3	"	"
35 11.2	89.8	0.9	0.6	−0.3	43.6	0.5	0.6	+0.1	"	"
6 07 50.2	82.3	7.5	8.2	+0.7	51.3	7.7	8.2	+0.5	B²	P
15 12.3	78.7	3.6	1.8	−1.8	55.0	3.7	1.8	−1.9	"	"
20 01.3	77.4	1.3	1.2	−0.1	55.4	0.4	1.2	+0.8	"	"
22 47.3	77.8	−0.4	+0.7	+1.1					"	"
31 11.5	75.0	+2.8	2.1	−0.7	57.8	2.4	2.8	+0.4	"	"
33 41.2	74.0	1.0	0.6	−0.4	57.7	−0.1	+0.6	+0.7	"	"
37 38.3	73.2	0.8	1.0	+0.2					"	"
46 32.1	71.2	2.0	2.2	+0.2	59.4	1.7	1.0	−0.7	"	"
7 05 13.7	66.5	4.7	4.7	0.0	61.6	2.2	2.2	0.0	"	"
08 43.7	65.3	1.2	0.9	−0.3					"	"
22 42.9	61.7	3.6	3.5	−0.1	67.6	6.0	5.5	−0.5	"	"
30 09.2	59.8	1.9	1.9	0.0	71.0	3.4	3.5	+0.1	"	"
32 39.2	60.3	−0.5	+0.6	+1.1	72.1	1.1	1.9	+0.8	B¹	W
35 13.7	59.3	+1.0	0.6	−0.4	72.8	0.7	0.6	+0.1	"	"
8 04 21.7	51.0	8.5	7.3	−1.2	73.8	1.0	0.6	−0.4	"	"
19 24.9	47.3	3.7	3.8	+0.1	81.8	8.0	7.3	−0.7	"	B²
21 56.2	46.9	0.4	0.6	+0.2	85.6	3.8	3.8	0.0	"	"
24 49.4	45.6	1.3	0.7	−0.6	86.3	0.7	0.6	−0.1	"	"
46 37.3	40.4	5.2	5.4	+0.2	87.7	1.4	0.7	−0.7	"	"
50 36.8	38.6	1.8	1.0	−0.8	92.7	5.0	5.4	+0.4	"	"
9 00 31.0	38.3	0.3	2.5	+2.2	94.2	1.5	1.0	−0.5	"	"

* The original record was 22.0 s., but partially altered to this effect.

† Apparently in error 2 s. for 40.6.

"*Micrometric Measurements for Differences of Declination of Mercury and the Sun's North and South Limbs. Corrected for Refraction.*

Sidereal Time of Observation.	Diff. of Dec. of Mercury and Sun's Limb.	Observed relative motion in Dec.	Computed relative motion in Dec.	Diff.	Observer.
h. m. s.	N. ′ ″	″	″	″	
3 00 43	18 45.3				B[1]
21 09	19 26.1	40.8	36.8	— 4.0	"
26 14	19 41.3	15.2	9.2	— 6.0	"
4 01 39	20 47.7	66.4	63.7	— 2.7	"
8 29	20 50.3	2.6	14.1	+ 11.5	"
13 45	21 05.6	15.3	9.5	— 5.8	"
	S.				
29 18	10 27.2				"
39 33	10 18.7	8.5	18.5	+ 10.0	"
47 38	10 02.7	16.0	14.6	— 1.4	"
5 02 33	9 31.6	31.1	26.8	— 4.3	"
9 42	9 25 5	6.1	12.9	+ 6.8	"
27 38	8 47.7	37.8	32.3	— 5.5	"
42 12	8 19.2	28.5	26.2	— 2.3	"
49 51	8 04.5	14.7	13.8	— 0.9	"
6 02 04	7 32.5	32.0	22.0	— 10.0	B[2]
11 26	7 25.3	7.2	16.8	+ 9.6	"
17 00	7 05.4	19.9	10.0	— 9.9	"
28 02	6 38.3	27.1	19.8	— 7.3	"
35 50	6 32.5	5.8	14.0	+ 8.2	"
42 04	6 21.8	10.7	11.3	+ 0.6	"
7 02 50	5 42.1	39.7	37.4	— 2.3	"
20 52	5 15.5	26.6	32.6	+ 6.0	"
27 42	4 59.8	15.7	14.1	— 1.6	"
58 58	4 06.8	53.0	56.3	+ 3.3	"
8 17 32	3 30.2	36.6	33.4	— 3.2	"
27 13	3 13.4	16.8	17.5	+ 0.7	B[1]
30 01	3 14.8	— 1.4	5.1	+ 6.5	"
30 49	3 09.0	5.8	1.4	— 4.4	"
31 58	3 05.0	4.0	2.1	— 1.9	"
32 31	3 06.7	1.7	1.0	+ 2.7	"
42 27	2 44.1	22.6	17.8	— 4.8	"
45 45	2 42.0	2.1	5.9	+ 3.8	"
49 39	2 35.5	6.5	7.0	+ 0.5	"
57 17	2 22.8	12.7	13.7	+ 1.0	"

3. Observations on the Comets of 1845 and 1846.

Observations on the Comet of June, 1845, *made at the Cambridge Observatory.* Lat. 42° 22′ 49″. Long. 4h. 44m. 32s.

The observed differences of A. R. and Dec. were applied to the A. R. and Dec. of the stars referred to the mean equinox of January 1st, 1846.

Cambridge Mean Solar Time.	Comet's A. R.	Comet's Dec. N.	Star of Comparison. A. R.	Star of Comparison. Dec. N.	No. of Comp.	
1845. d. h. m. s.	h. m. s.	° ′ ″	h. m. s.	° ′ ″		
June 2 15 39 06	3 27 32.7	38 15 27	3 24 59.57	38 03 37.0	4	Bessel's Zone, 448.
" 4 15 21 25	4 01 55.6	41 48 41	3 34 41.02	42 05 01.4	6	B. A. Cat.
" 6 15 18 34	4 42 38 2	44 19 45	3 39 18.04	44 29 19.8	4	"
" 9 08 52 03	5 41 06 8	45 28 08	5 48 09.44	44 55 28.3	2	"
" 10 10 01 21	6 02 32.0	45 12 01	5 48 09.44	44 55 28.3	2	"
" 11 09 30 30	6 21 17.1	44 39 58	5 48 09.44	44 55 28.3	1	"
" 13 09 24 52	6 54 45.8	42 56 08	7 10 05 81	42 56 18.0	2	Groombridge, 1296
"			7 11 47.16	42 57 04.1	2	" 1302.
" 14 10 19 30	7 09 22.6	41 49 53	6 39 47.90	41 57 21.0	2	B. A. Cat.
" 17 9 42 35	7 43 17.2	38 15 39	7 36 18.32	37 53 10.7	3	Bessel's Zone, 493.
" 19 9 22 19	7 59 56.0	35 52 39	8 00 05.23	35 54 56.0	3	" 451.
	Comet-star.	Comet-star.				
" 24 09 02 57	— 14.6	+ 06 04.2	8 29	30 30	1	Star is unknown.
" 25 09 29 04	8 32 40.7	29 28 35	8 37 18 50	29 19 19.6	2	B A. Cat.
" 26 09 13 23	8 36 26.1	28 33 35	8 37 45.90	28 43 34.3	2	Bessel's Zone, 350.
"			8 43 07.56	28 50 10.7	2	B. A. Cat.
"			8 43 21.03	28 55 06.2	2	"
"			8 46 21.86	28 30 54.3	2	"

"The comet was first seen at 14h. 15m., June 2d. The observations of this morning are made with the spider-line micrometer, and under favorable circumstances.

"*June 4th.* The differences of A. R. were obtained this day from the hour-circle of the equatorial, which reads to single seconds of time. The comet could be seen with the naked eye after most of the stars of the second magnitude had disappeared. It being somewhat cloudy, the length of the tail could not be well determined. The nebulosity was very much condensed and beautifully defined: near the head of the comet, the tail was plainly divided into two branches.

"*June 6th, A. M.* The head of the comet broad and full; in the course of six hours, it has undergone a remarkable change, becoming pointed, and appearing with a spur or secondary tail (which is the brightest of the two) of two degrees in length. The axes of the tails are inclined at an angle of twenty degrees, though the estimation is quite uncertain. The principal tail may be traced through five degrees. The observations are made as on the 4th.

"On the 9th and 10th, the observations are made with the spider-line

and annular micrometers. The changes in the physical appearance of this comet from night to night are particularly interesting.

"*June* 25*th*. Observed with the spider-line and annular micrometers, the comet being still sufficiently bright to bear illumination; its tail is one or two degrees long.

Observations on the Comets of February and May, 1846.

Cambridge Mean Solar Time.	Comet's A. R.	Comet's Dec. N.	Star of Comparison. A. R.	Star of Comparison. Dec. N.	No. of Comp.	
1846. d. h. m. s.	h. m. s.	° ′ ″	h. m. s.	° ′ ″		
Feb. 26 08 11 44	1 00 25.7	3 19 17	0 57 45.04	3 22 26.1	2	Bessel's Zone, 36.
Mar. 1 07 35 35	1 00 32.6	8 08 35	0 58 40.18	8 02 22.0	3	Hist. Cel., p. 128.
" 2 07 30 06	1 00 26.1	9 42 34	0 03 24.92	9 28 14.3	3	B. A. Cat., 351.
" 3 07 17 51	1 00 16.6	11 13 36	1 01 10.55	11 12 24.8	3	Bessel's Zone, 194.
" 4 07 42 56	1 00 01.7	12 46 05	0 58 29.95	13 03 41.0	3	" "
" 5 08 35 54	0 59 41.6	14 17	0 56 58.06	14 07 00.0	1	B. A. Cat., 305.
" 6 08 12 46	0 59 18.3	15 43 23	1 05 57.20	15 18 58.5	3	" 370.
" 9 07 08 49	0 57 47.7	19 48 46	0 59 42 10	19 55 07.2	3	" 322.
" 10 07 27 39	0 57 09.0	21 08 56	0 59 52.02	21 09 17 9	3	Bessel's Zone, 280.
" 11 07 43 06	0 56 27.3	22 27 31	0 48 59.75	22 37 46.3	2	B. A. Cat., 264.
" 12 07 26 45	0 55 42.6	23 41 42	0 50 12.40	23 41 20.4	3	Bessel's Zone, 331.
" 17 07 38 10	0 51 14.3	29 33 41	0 49 38.43	29 29 06.2	2	Hist Cel., p. 307.
" 18 08 22 12	0 50 11.7	30 41 01	0 54 23.60	30 58 36.0		Bessel's Zone, 390.
"			0 55 40.29	30 40 27.0	1	" "
" 21 07 30 16	0 46 57.4	33 45 28	0 48 45.67	34 01 38.1	1	Hist. Cel., p. 90.
"			0 49 28.77	34 09 19.1	1	"
" 31 07 50 45	0 34 15.2	42 51 32	0 33 56.57	43 05 35.1	4	Bessel's Zone, 443.
Apr. 1 07 51 48	0 32 49.4	43 40 50	0 28 25.17	43 38 17.4	3	B. A. Cat., 152.
" 2 08 07 58	0 31 20.6	44 30 00	0 29 14.28	44 45 21.2	3	Bessel's Zone, 444.
" 3 16 24 21	0 29 21.4	45 34 17	0 38 18.36	45 31 19.0	2	Hist. Cel., p. 249.
" 14 08 31 14	0 11 27.5	53 33 35	0 08 32 67	53 48 09.7	3	" p. 373.
" 15 08 54 17	0 09 27.8	54 17 05	0 02 44.56	54 29 05.5	3	" "
"			0 09 06.14	54 07 29.6	3	" "
" 16 08 20 08	0 07 32.0	54 58 59	0 04 55.59	55 00 08.1	4	" "
" 27 15 30 35	23 38 11.0	62 47 10	23 40 39 91	62 57 42.3	2	Groomb. Cat., 4142,
"			23 42 55.73	62 53 14.8	2	" " [4149.
May 4 15 02 17	23 09 51.1	67 21 12	23 12 19 32	67 16 10.8	4	B. A. Cat., 8124.
" 18 10 48 16	21 20 44.5	74 35 44	21 10 17.07	74 36 46.9	3	" 7393.
" 19 11 07 28	21 08 56.3	74 54 23	21 04 30.00	74 54 50.0	3	Hist. Cel., p. 364.

Comet of May, 1846.

May 19 12 15 02	6 34 58.4	51 31 06	6 41 18.82	51 41 44.6	5	Groombridge, 1226.
" 20 08 55 00	6 39 20.	50 15			1	Instrumental Read-
" 21 09 11 44	6 44 05.7	48 55 48	6 35 54.97	48 56 39 5	1	B. A. C., 2201. [ing.
"			6 43 01.69	49 05 11.6	9	Hist. Cel., p. 383.
" 22 09 01 38	6 47 44.5	47 43 00	6 45 48.21	47 28 10.0	5	" p. 376.
June 3 09 31 20	7 01 27.8	38 11 46	7 03 12.33	38 21 45.0	2	" pp. 208, 209.
"			7 00 41.47	38 26 35.3	4	
" 12 09 02 48	6 57 49.3	33 58 13	6 58 06.63	34 04 00.3		" p. 212.

4. Solar Eclipse of May, 1845.

Micrometric Measurements during the Solar Eclipse of May 5th, 1845. Corrected for Refraction.

Cambridge Observatory, Lat. 42° 22′ 49″, Long. $4^{h.}\ 44^{m.}\ 32^{s.}$

Mean Solar Time.	Observed Diff. of Dec.	Cor. for Refract'n.	True Diff. of Dec.	
d. h. m. s.	′ ″	″	′ ″	
May 5 17 00 43.0	14 51.8	+ 48.4	15 40.2	Diff. of Dec. of the sun's north limb and the south cusp.
4 57.5	16 05.3	+ 40.2	16 45.5	" "
7 19.1	16 17.2	+ 33.8	16 51.0	" "
9 54.0	1 39.7	+ 02.3	1 42.0	Diff. of Dec. of the sun's north limb and the north cusp.
11 28.3	2 12.1	+ 02.9	2 15.0	" "
13 20.0	2 49.1	+ 03.5	2 52.6	" "
14 46.0	3 31.4	+ 03.7	3 35.1	" "
15 31.7	4 04.7	+ 04.2	4 08 9	" "
17 21.1	5 22.2	+ 05.0	5 27.2	" "

"Note. The sky was clear, but the sun's limb was very tremulous. The refraction corrections are somewhat uncertain, the sun being but one degree above the horizon at the commencement of the series. The observations were made by William C. Bond with the 46-inch equatorial telescope (aperture 2¾ inches), and Troughton's spider-line position micrometer.

"The time of ending of the eclipse, expressed in mean solar time for the meridian of this Observatory, as observed by Hon. William Mitchell, with an achromatic telescope, by Tully, of 3¼-inch aperture and 45 inches focus, was $5^{d.}\ 17^{h.}\ 18^{m.}\ 02.2^{s.}$

"As observed by W. C. Bond, with a refractor by Troughton and Simms, of 2¾-inch aperture and 46 inches focus, it was $5^{d.}\ 17^{h.}\ 18^{m.}\ 04.3^{s.}$

"As observed by George P. Bond, with a refractor by Lerebours, having a rock-crystal object-glass of 3 inches aperture and 4 feet focus, it was $5^{d.}\ 17^{h.}\ 18^{m.}\ 04.2^{s.}$

5. Solar Eclipse of April, 1846.

Micrometric Measurements during the Eclipse of April 24th, 1846. *Corrected for Refraction and for the Sun's Motion in the Intervals of Transit.*

Cambridge Observatory, Lat. 42° 22′ 49″, Long. $4^{h.}\ 44^{m.}\ 32^{s.}$.

Mean Solar Time. April, 1845. d. h. m. s.	Dist. and Diff. of Dec. ′ ″	Differences of A. R. m. s.	Observations by W. C. B.
24 23 17 23.8	8 43.5		Distances of cusps.
20 22.2	11 07.5		" "
23 42.6	13 32.0		" "
26 00.3	15 02.5		" "
33 46.4	10 56.0		Differences of declination of the cusps.
43 42.0	11 27.7		" "
43 44.8		2.01	Diff. of A. R. of sun's 1st limb and preceding cusp.
45 06.1		47.30	" " 2d limb and following cusp.
51 04.0	11 01.0		Diff. of declination of the cusps.
51 06.0		1.80	Diff. of A. R. of sun's 1st limb and preceding cusp.
52 38.2		37.00	" " 2d limb and following cusp.
25 00 09 08.7		3.79	" " 1st limb and preceding cusp.
09 05.0	16 25.5		Diff. of declination of the cusps.
15 21.0	15 34.4		Diff. of A. R. of the cusps.
15 26.6		5.08	Diff. of A. R. of sun's 1st limb and preceding cusp.
20 33.4	14 54.8		Diff. of Dec. of the north limbs of sun and moon.
24 36.4	14 19.9		" " "
28 22.1	13 57.1		" " "
30 43.2	13 37.9		" " "
32 54 6	13 21.2		" " "
34 29.5	13 07.1		" " "
37 41.4	12 48.4		" " "
39 15.3	12 37.3		" " "
41 17.5	12 24 4		" " "
42 38.5	12 12.7		" " "
43 59.6	11 56.8		" " "
45 22.8	11 49.3		" " "
47 01.8	11 42.8		" " "
49 52.3	11 20 9		" " "
50 48.3	11 11.0		" " "
51 39.5	11 05 5		" " "
52 56.3	10 54.7		" " "
54 56.0	10 40.7		" " "
56 11.1	10 34.3		" " "
1 10 01.7	17.0		Diff. of Dec. of sun's south limb and south cusp.
13 11.3	26.3		" " "
15 11.7	36 8		" " "
17 08.7	49.8		" " "
18 21.5	59.6		" " "
29 52.8		1 37.74	Diff. of A. R. of sun and moon's 1st limbs, and of
30 20.3		2 05.16	" [sun's 1st limb and north cusp.
33 27.9		1 42.01	" " "
33 51.0		2 05.11	" " "
36 32.7		1 46.66	" " "
39 51.1		1 51 74	" " "
40 06.8		2 07.41	" " "
42 36 3		1 55 78	" " "
42 36.3		2 08 70	" " "
47 25.0	9 58 1		Distances of the cusps observed by G. P. Bond.
48 30.2	9 23.7		" " "
49 20.9	7 42 4		" " "
50 18.7	6 21.4		" " "

"The times of the beginning and ending of this eclipse were noticed by four observers. The beginning,

d.	h.	m.	s.	
24	23	14	17.2	by W. C. Bond, with a 5-foot refractor.
			20.7	" G. P. Bond, with a 46-inch refractor.
			26.8	" R. T. Paine, with a reflector of 4-inch aperture.
			35.2	" Prof. Peirce, with a 20-inch Var. Transit.

End,

d	h.	m.	s.			
25	01	52	23.0	by Prof. Peirce, with the same instrument as before."		
			14.6	" W. C. Bond,	"	"
			12.4	" George P. Bond,	"	"
			09.1	" R. T. Paine, Esq.,	"	"

Professor Peirce also communicated, from Mr. William Cranch Bond, Director of the Cambridge Observatory, the following

NOTES ON METEORS.

"1845. *August* 10*th*. Watched for the 'meteoric shower' of this period; but no meteors whatever were seen. The moon shone quite brightly, while the sky was about half covered with cirro-stratus cloud.

"*August* 11*th*. A brilliant meteor was seen from the Sears Tower, in broad daylight, at $6^{h.}$ $05^{m.}$. Altitude, 25° 30′. Azimuth south, 75° east. It described an arc of about seven degrees in one second of time. The color was white, appearing to increase in brilliancy; the form irregular, the estimated diameter less than five minutes. The sky was nearly clear in the direction where the meteor was seen, the sun shining dimly at the time through cirrus cloud. The intensity of the light of this meteor was such as to render it a more conspicuous object than the moon at full would have been. The same meteor was probably seen in Essex, Connecticut, and in the vicinity of Cincinnati, Ohio; but the accounts are not sufficiently precise to enable us to determine its course and distance.

"*August* 25*th*. A meteor was seen from the vicinity of the College buildings, at about eight o'clock. It appeared of one half the diameter of the moon. By a comparison of the different accounts, its *altitude*,

when first seen, seems to have been about 45°, azimuth south 10° west, and it crossed the meridian in a path inclined fifty degrees to the horizon; its course being towards the southeast, through an arc of ten or twenty degrees. The colors were red and blue. This same body was also seen from New Haven, Connecticut; and, from a comparison of the New Haven and Cambridge apparent positions, it appears that the distance of the meteor, when first seen, was about one hundred and fifty miles from our station, and its height above the earth one hundred miles. It passed over Newport, Rhode Island, Taunton and Quincy, Massachusetts, descending to the earth near Boston Bay. Meteors of large size have been of frequent occurrence in different parts of the world during the months of August and September of this year.

"1846. Telescopic meteors have frequently passed the field of view of the comet-seeker during this season, sometimes as many as five or six on a single night. From their comparative velocities, these would seem to be more distant than those visible to the naked eye.

"*July* 20*th*. At $9^{h.}$ $55^{m.}$ a meteor was seen from the Observatory, in brightness equal to Venus; its course from 77 Cygni to near α Cassiopeæ; its color preceding was a dark red, inclining to purple; the following, a yellowish white. The position was well determined by two observers; but we have no other observations of it for comparison.

"Several attempts have been made to ascertain the amount of parallax of the smaller shooting-stars, but the evenings selected for the purpose have proved unfavorable. In some instances, however, the results seem to indicate a closer proximity than has usually been assigned to these objects.

"*August* 10*th*. Evening cloudy, with rain.

"*August* 11*th*. This evening, shooting stars were abundant, averaging about one in a minute, in a space occupying one quarter of the heavens. The head of Perseus was the principal radiating point. At $10^{h.}$ $10^{m.}$ a meteor, brighter than Venus, passed from α Cassiopeæ, through the square of Pegasus, to about 80 Pegasi. The colors were blue preceding, followed by red and white; it had a cometary tail of dense white light."

Mr. Emerson, in behalf of a committee appointed at a former meeting to consider the subjects of "the relation between the Chinese language, and the languages of Northwestern Europe," and "of Phonotypy and Phonography," remarked, that the committee were not prepared to offer any formal statement on the first-named topic, further than to recommend that Mr. S. P. Andrews, who had been present at nearly all the meetings of the committee, be invited to present his views in a memoir, to be laid before the Academy. Upon the subject of *Phonotypy*, Mr. Emerson made the following report.

"Few subjects can present stronger claims to the attention of all persons interested in the advancement and perfection of the arts of writing and printing, than Phonotypy and Phonography.* Phonotypy has for its object a reform in the existing modes of representing language by printed types. Phonography has the higher object of bringing into use a mode of representing sounds by written characters, which shall be more scientific, more exact, more easily acquired, and four or five times more rapid, than any now in general use.

"The necessity of a reform in the received mode of representing the sounds of our language has occurred to very many persons,† at different times, within the last two or three hundred years. Indeed, this necessity must have been apparent to every philosophical observer who has attentively considered the extreme inadequacy of the small and very imperfect Phœnician alphabet, however modified by Greek and Roman usage, when adopted to express the sounds of a language derived from so many sources, and having so broad a compass and so

* Phonotypy is the art of printing, Phonography of writing, according to sound.

† Sir John Cheke, appointed professor of Greek at Cambridge by Henry the Eighth, in 1540, and knighted by Edward the Sixth, in 1551, made some attempts to improve the orthography of the language. One of his devices was the one so often proposed, of expressing long vowel-sounds by double vowels. His friend and associate in the reform of the pronunciation of Greek, Sir Thomas Smith, also proposed a reform in the orthography of English. Both these were among the most learned men of their times. Many others have appeared, from Mulcaster, in 1582, to Rich, of Troy, New Hampshire, in 1844.

great a variety of sounds, as the English.* The most distinguished of those who have gone so far as to propose a reform are Bishop Wilkins, Sir William Jones, and Dr. Franklin; all of them eminently conspicuous for their strong common sense, and two of them for practical, every-day wisdom. Bishop Wilkins made a most elaborate analysis of the sounds of spoken language, and proposed two very distinct modes of representing them. His essay was received by the Royal Society and ordered to be printed, on the 13th of April, 1668. This analysis was unfortunately proposed as a part of *An Essay towards a Real Character and a Philosophical Language*, and therefore did not attract all the attention to which it was entitled.†

"Dr. Franklin did not apparently go so fully into the subject as Bishop Wilkins; fully enough, however, to show his conviction of the importance and feasibility of the reform. He proposed eight vowels, including *h*, and eighteen consonants. He invented a character for *sh*, one, ŋ, for *ng*, a modification of *a* for *au*, and separate characters for *th* whispered and *th* vocál. He recognized the natural division of consonants by pairs; but had not distinct signs for the long vowels, but expressed them by the short vowels doubled. He omitted *c*, *j*, *q*, *w*, *x*, and *y*; considering *j* as compounded of *d* and *sh*, *ch* as compounded of *t* and *sh*, and *zh* as compounded of *z* and *sh*. He evidently left the work incomplete.

"Sir William Jones, in a dissertation published more than fifty years ago, and prepared with that thoroughness of research for which

* The English language must be made up of the languages of the Celts, who occupied the island before the inroads of the Romans, and who have left dialects of their tongue among the Welsh, Cornish, Irish, and Gaelic; of the Latins of the times of the emperors; of the Danish and Norwegian invaders, many of whom made permanent settlements and spoke Scandinavian dialects; of the Saxon and Danish or Angle invaders of a later age, who formed the Saxon octarchy, speaking German languages; of the Normans of the Conquest, speaking the old French; of the modern French; of classical Latin, introduced with literature by learned men; of Greek, introduced in the same way, as the language of science; of Italian, as the language of the arts; and of words from various other sources.

† Bishop Wilkins recognizes the binary division of consonants, and applies it to all the consonant-sounds, making twenty-six consonants, six letters of a middle nature, and five vowels, *e*, *a*, *â*, *o*, *u*. In his arrangement he begins with sounds formed in the throat, or "inmost palate," and comes out to those formed by the lips. He speaks of possible gutturals and lip sounds which do not occur in any language, and are not therefore to be provided with a symbol.

The following is his arrangement of the letters, which is here presented as

he was remarkable, proposed, for the purpose of representing the sounds of Asiatic words, a new system of vowels and consonants, which were

probably the earliest philosophical analysis of the sounds of our language which has been published in English.

Letters may be considered according to											
The organs by which they are framed, whether			Their natures.								
Active.		Passive.	Breathless.	Breathing through the nose.	Breathing through the mouth. Intercepted. Proceeding from the middle of the mouth.	Breathing through the mouth. Intercepted. Proceeding from each side of the mouth.	Breathing through the mouth. Intercepted. Made by Trepidation of the tongue.	Breathing through the mouth. Intercepted. Made by Whistling. dense.	Breathing through the mouth. Intercepted. Made by Whistling. subtle.	Breathing through the mouth. Free. Of a middle nature.	Breathing through the mouth. Free. Vowels.
Tongue,	root,	Inmost palate,	c, g;	ngh, ng;	ch, gh;					h, y.	
Tongue,	tip,	Foremost palate or root of the teeth.	t, d;	nh, n;	th, dh	lh, l;	rh, r;	sh, zh;	s, z;	hy, i;	e, a, a.
One lip,		The other lip,	p, b;	mh, m;						hw, w;	o, u.
One lip,		Tops of the teeth,			f, v.						
			Mute. Sonorous.	Mute. Sonorous.	Mute. Sonorous.	Mute. Sonorous.	Mute. Sonorous.	Mute. Sonorous.	Mute. Sonorous.	Mute. Sonorous.	

to be represented by those already existing, by the somewhat profuse use of compounds and diacritical marks.*

"The necessity of a reform is very apparent from an examination of our present alphabet, as used to express the sounds of our language.

"I. Our alphabet is inadequate; there being thirty-eight or forty sounds, and several combinations of sounds, to be expressed, and only twenty-six characters.

"II. It is redundant; three of these twenty-six, namely, *k*, *q*, and *x*, standing for sounds which are represented by other letters; and *q* being by itself without significance.

"III. It is uncertain, contradictory, and false; each of the vowel-signs representing several sounds,† namely:—

a, not less than	9;
e, " "	7;
i, itself a diphthong,	5;
o, not less than	9;
u, also a diphthong,	8;
y, not less than	5;

and each of these sounds being represented by other letters or combinations of letters, the first sound of

a, by 19	different combinations	of letters.
e, by 21	"	"
i, by 17	"	"
o, by 16	"	"
u, by 17	"	"
y, by 4	"	" ‡

* See his *Dissertation on the Orthography of Asiatic Words in Roman Letters*, in the first volume of his works, edited by Lord Teignmouth, 1st ed., p. 175.

† The sound of *a* is different in each two of the following words: imaging, mating, many, paring, father, fat, fall, want, dollar; of *e*, in the following: he, pretty, met, clerk, rendezvous, burden, blame; of *i*, in admiration, stir, sin, bind, business; of *o*, in women, nor, hop, work, sow, go, do, woman, compter; of *u*, in busy, bury, cur, but, unruly, pull, usage, persuade; of *y*, in pity, physic, myrrh, fly, yard.—See Ellis's *Plea for Phonotypy*, p. 8.

‡ As in the following words: of *a*, by *a* in m*a*ting, *a-e* in m*ate*, *a-ue* in pl*ague*, *ai* in p*ai*n, *aigh* in str*aigh*t, *ao* in g*ao*l, *au* in g*au*ging, *au-e* in g*auge*, *ay* in pr*ay*, *aye* in pr*aye*d, *ea* in gr*ea*t, *ei* in v*ei*l, *eig* in r*eig*n, *eigh* in w*eigh*, *eighe* in w*eighe*d, *ey* in th*ey*, *eye* in conv*eye*d, *eyo* in *eyo*t, *ez* in rend*ez*vous; of *e*, by *æ* in C*æ*sar, *e* in b*e*, *e-e* in compl*ete*, *ea* in *ea*ch, *ea-e* in l*eave*, *ee* in f*ee*t, *eg* in impr*eg*n, *ei* in conc*ei*t, *ei-e* in conc*eive*, *eo* in p*eo*ple, *ey* in k*ey*, *eye* in k*eye*d, *i* in alb*i*no, *i-e* in magaz*ine*, *ia* in parl*ia*ment, *ie* in gr*ie*f, *ie-e* in gr*ieve*, *œ* in f*œ*tus, *uay* in

"There are fourteen simple vowel-sounds,* and four diphthongs, *i*, *oi*, *ou*, *u*; in all eighteen, to be represented; and there are only six vowel-signs to represent them. They are distributed without any apparent order, or rather in defiance of all order, method, or principle.

"The representatives of the consonant-sounds are not so extravagant; there being only twenty-two or twenty-four consonant-sounds to be represented, and twenty, or rather seventeen, letters to represent them. The representation of these is, however, sufficiently fantastic; two of the perfectly simple consonants, *c* and *t*, being represented in ten different modes each.† On the whole, the thirty-six simple, and six or seven compound sounds, for which it is desirable to have characters, are represented in our language by three hundred and sixty-seven equivalents, an average of more than eight and one half to each sound, amongst which the inexperienced writer has to choose; — and *not a single sound of the English tongue has one uniform representative.* The case is somewhat better for the reader. There are about two hundred letters or equivalents for letters in use, to represent the thirty-seven sounds of our language. Some of these have each a single value; but many of them have a considerable number. Among those of most common occurrence are the combinations *ei*, *eo*, *ie*, and *ough*, which have respectively seven, nine, eleven, and nine values.‡

q*ua*y, *ui* in mosq*ui*to, *y* in carr*y*; of *i*, by *ais-e* in *ais*l*e*, *ei* in n*ei*ther, as often pronounced, *eigh* in h*eigh*t, *ey* in *ey*ing, *eye* in *eye*, *i* in b*i*nd, *i-e* in m*i*n*e*, *ic* in in-di*c*t, *ie* in l*ie*, *ig* in s*ig*n, *igh* in h*igh*, *is-e* in *is*l*e*, *ui* in beg*ui*ling, *ui-e* in beg*ui*l*e*, *uy* in b*uy*, *y* in fl*y*, *ye* in d*ye*; of *o*, by *au* in h*au*teur, *eau* in b*eau*, *eo* in y*eo*man, *ew* in s*ew*, *o* in g*o*, *o-e* in c*o*v*e*, *oa* in c*oa*l, *oe* in d*oe*, *oh* in *oh!* *ol* in y*ol*k, *oo* in br*oo*ch, *ou* in s*ou*l, *ough* in th*ough*, *ow* in kn*ow*, *owe* in *owe*, *wo* in s*wo*rd; of *u*, by *eau* in b*eau*ty, *eo* in f*eo*d, *eu* in f*eu*d, *ew* in f*ew*, *ewe* in *ewe*, *hu* in *hu*mor, *ieu* in l*ieu*, *iew* in v*iew*, *iewe* in v*iewe*d, *u* in *u*sage, *u-e* in *u*s*e*, *ue* in ag*ue*, *ug* in imp*ug*n, *ugh* in H*ugh*, *ui* in s*ui*t, *yew* in *yew*, *you* in *you*; of *y*, by *e* in court*e*ous, *i* in on*i*on, *j* in hallelu*j*ah, *y* in *y*ard. — See Ellis's *Plea*, pp. 5–8.

* Namely: i (ee), as in feet; i, as in it; ɛ (a), as in mate; e, as in met; æ, as in mare; ɑ, as in Sam; a, as in psalm; ɵ, as in caught; o, as in cot; u, as in cur; ʉ, as in curry; o, as in bone; ɯ, as in fool; and u, as in full.

† *C* in *c*an, *ch*asm, a*ch*e, ba*ck*, lou*gh*, *k*ill, wal*k*, *q*uack, *q*uay, e*x*ception; *t* in de*bt*, indi*ct*, suck*ed*, sou*ght*, *phth*isical, *pt*armigan, *t*oe, *Th*omas, ha*tt*er, mezzo*t*int. — *Ellis*, p. 7.

‡ The sounds of *ei* are different in every two of the words conceit, forfeit, veil, heifer, their, Leipsig, reimburse; of *eo*, in people, leopard, dungeon, yeoman, galleon, feod, Macleod, aureola, theology; of *ie*, in grief, pitied, friend, soldier, lie, medieval, conscientious, piety, crier, species, courier; of *ough*, in sought, though, through, plough, cough, hough, trough, hiccough, and tough.

The two hundred effective letters have only about five hundred and fifty values, an average of two and one half each. So that to guess what value to give to each letter when written is easier than to divine what symbols to choose to represent a sound uttered, in the proportion of two and one half to eight and one half, or of twenty-five to eighty-five.

"Of the fifty thousand words of our language which have been examined, not more than fifty, or one in a thousand, are pronounced as they are spelt, that is, if we take the first sound or name-sound of each letter as indicating its power. Hence the spelling of a word is no infallible guide to its pronunciation; and there is absolutely no way of indicating, by the alphabet now in use, what the pronunciation of a word should be.

"From the very anomalous and irregular nature of our written language follows the extreme difficulty of learning to read, it taking children not less than fifteen times as long as if each sound had one sign, and each sign one invariable sound. The difficulty is not simply what it would be if they had two hundred characters to learn. It is far greater. In regard to many of the letters and combinations, a child can never learn the sound. He can only learn that the sound is to be ascertained by authority, whenever the letter occurs. Take, for example, the first letter of the alphabet as occurring in the following sentence.

"'Ma[1]ny, compa[2]ring this ma[3]n with his fa[4]ther, fa[5]ll into the mista[6]ke tha[3]t he wa[7]nts little of being a[8]n ima[9]ge of him.'

"Here are nine different sounds of the *a*; and a child who had mastered them would be none the better prepared to give the sounds of *a* in any other word which should occur. He could at best guess that it had one of these nine sounds, and proceed to try them in succession, but each of the nine guesses would be wrong if the word were *bread* or *heaven*, or any other in which *a* is silent. Or take the letter *e* in the following sentence:—

"'Let her leave her burden at the rendezvous, and show the clerk her pretty tame mouse.'

"Here the letter has eight different sounds or powers, and the effect of learning it would be only to confuse the mind in reference to the sound of *e* in every word not contained in this sentence. Take one of the combinations of two letters, *ai*, for instance, in this sentence:—'Captain Paine said he had a pair of plaids.' After learning the five sounds

here given, if the learner should read in Scott an account of a feast at a Saxon's table, he would have to guess five times at the pronunciation of *dais*, and each time wrong. The written language is continually misleading thus, and it may be safely said that the sound of a word is learnt, not through the aid of the vowels, but in spite of them. Our language is full of rules, and still more of exceptions. A true alphabet would require no rules, and it would admit of no exceptions. It would always speak for itself. In our present alphabet, every letter oftentimes misleads us, and every letter is sometimes lost. 'It is really deplorable,' as Sir William Jones, speaking of our alphabet, says, 'that our first step from total ignorance should be into gross inaccuracy, and that we should begin our education in English with learning to read the five vowels, two of which, as we are taught to pronounce them, are clearly diphthongs.' — *Works*, 1st ed., Vol. I., p. 183.

"The truth is, that there is such an absence of rule, principle, and analogy in our language, as now written, that it is not to be wondered at that so few learn to read well, and that *nobody learns to spell.** 'Such is the state of our language,' says Sheridan, a man certainly not prejudiced against his native tongue, 'that the darkest hieroglyphics, or most difficult ciphers that the art of man has hitherto invented, were not better calculated to conceal the sentiments of those that used them from all that had not a key, than the state of our spelling is to conceal the true pronunciation of words from all except a few well educated natives.' Such are the difficulties of our language, that with most foreigners beyond the period of early youth the acquisition of a tolerably correct pronunciation is quite impossible; and, in regard to proper names, no person, whether native or foreigner, who has not heard them, can be sure of their pronunciation.†

"The IMPORTANCE of the reform is not less apparent than its necessity. Our language is one of the simplest, richest, and most comprehensive and expressive of languages, and ought to be one of the easi-

* Men who have most to do with the press, and who are therefore most likely to know how to spell, have to confess that they wear out a dictionary in looking for the spelling of words. Can a man be found who never doubts about the spelling of a word?

† Take the instance of the new name, Cochituate, proposed for Long Pond. No person, on reading it, can be sure whether the *o* in the first syllable is long or short, whether *ch* in the second is sounded like *k*, like *sh*, or like *tch*, whether *u* is *u* or *oo*, and whether *ate* sounds long or short *a*, or short *i*, or short *e*; and there is a doubt about the accent.

est of acquisition. Those who speak it belong to the most energetic of all the races, and are everywhere, by might, or craft, or commercial enterprise, or philanthropic action, rapidly extending the area over which it is to be spoken. It is the language of liberty, of poetry, of inventions. It should be made accessible to all. Rapp, a person qualified to judge and to pronounce in the matter of languages, says: — 'Although the French is become the common language, in a diplomatic and social sense, it has never acquired a firm footing in extensive regions out of Europe. The English, on the contrary, may pass for the universal tongue out of Europe; and by its bold fusion and consequent decomposition of the forms of its Gothic and Roman elements, this idiom has acquired an incomparable fluency, and appears especially destined by nature, more than any one of the living, to undertake that part. Were not the impediment of a bizarre, antiquated orthography in the way, the universality of this language would be still more apparent; and it may, perhaps, be said to be fortunate for us other Europeans, that the Englishman has not made the discovery.' *

"The reform proposed by the author or authors of Phonotypy is simply the laying down and carrying out this most philosophical principle, — that each sound of the language should be represented by one and only one sign, and that each sign should constantly represent one sound. This principle is obviously the one on which every alphabet should be formed, and it is therefore, as the basis of the reform, a principle entirely satisfactory to the mind.

"In the analysis of the sounds of the language, aid has been sought and obtained from all accessible sources; from Wilkins, Sir William Jones, Dr. Franklin, Rapp, and especially Ellis; from the alphabets of other languages; from the structure of the organs of articulation, and from the construction of those ingenious philosophical instruments which have been contrived to imitate the sounds of language. Professor Wheatstone, taking advantage of all which has been done by Kratzenstein, Kempelen, and Professor Willis, contrived a simple tube, fitted with a reed and blown by means of bellows, which, of a certain length, gave the vowel I (ee); of another definite length, the vowel E (a); of another, the vowel A (ah); of another, O; and of another, indefinite, U (oo); and being gradually drawn out while blown, gave the series I, E, A, O, U,

* K. M. Rapp, *Physiologie der Sprache*, as quoted by a writer in the *Phonotypic Journal*, Vol. III., p. 249.

and on being farther drawn out, repeated these sounds in the reverse order, then, successively, with different lengths, the same series direct, and again reversed. This experiment settles the order of the vowel-sounds, which had also been already determined by the utterance of a continuous stream of vocal sound, with the parts of the mouth gradually changing their position. It does not determine at which end of the series the vocal sounds should be considered as beginning, which has been settled on other grounds. The *number* of vowel-sounds has been determined by a careful analysis of the spoken language. There seem to be fourteen well settled vowel-sounds in authorized use in the language.* Several others are sometimes heard; as, for example, the sound of ŏ in most, among ourselves. Four diphthongs, *i*, *oi*, *ou*, and *u*, from their frequent occurrence in the language, have symbols assigned them.

"The natural order of the consonant-sounds is determined by observing the organs of articulation employed in forming or modifying them, and the order settled upon by Mr. Pitman is that of labials, dentals, palatals, gutturals, nasals, beginning with those formed by the lips and going back to those formed by aid of the teeth, the palate, and the nose. The reverse of this order might have been taken; and has been taken by Bishop Wilkins and Dr. Franklin.

"What particular consonant-sounds are found in the language is determined, as in the case of vowels, by an analysis of the language itself. They are settled at twenty-four, including those of an ambiguous nature, represented by *w*, *y*, and *h*, and called coalescents, and the breathing represented by *h*. After exhausting the letters of the present alphabet, excluding *k*, *q*, and *x*, it became necessary to adopt nineteen new letter-signs for the unrepresented or misrepresented sounds. These

* Eight are long, as 1. *ee* in keep, 2. *a* in make, 3. *a* in mare, 4. *a* in mark, 5. *au* in caught, 6. *u* in burn, 7. *o* in pole, and 8. *oo* in fool; and six short, namely, 9. *i* as in pin, 10. *e* in met, 11. *a* in sat, 12. *o* in top, 13. *u* in cup, and 14. *oo* in foot. Of the short, only two correspond precisely to long sounds, namely, 11 to 3, and 12 to 5. The order in the phonic scale would seem to be nearly

1
  9
2
  10
3 — 11
4
5 — 12
6
  13
7
  14
8.

have been chosen with great care, and after very numerous experiments. The present form of the phonetic alphabet being as high as the seventeenth of those which have been successively proposed.

The proposed alphabet is the following: —

CONSONANTS.

Type.	Example of Sound.	Type.	Example of Sound.	Type.	Example of Sound.
P p	*pay*	Γ ŧ	*thigh*	Ȼ ç	*chew*
B b	*bay*	Ɖ đ	*thy*	J j	*Jew*
F f	*few*	S s	*seal*	Σ ʃ	me*sh*
V v	*view*	Z z	*zeal*	Ʒ ʒ	mea*s*ure
M m	su*m*	L l	bai*l*	C c	*c*all
W w	*way*	R r	ba*r*e	G ɡ	*g*all
T t	*toe*	N n	su*n*	Ŋ ŋ	su*ng*
D d	*doe*	Y y	*y*ea	H h	*h*ay

VOWELS.

Ɩ i	f*ee*t	Ꭿ ɑ	S*a*m	Ȯ o	b*o*ne
I i	f*i*t	A a	ps*al*m	U u	h*u*t
Ɛ ɛ	m*a*te	Ө ɵ	c*augh*t	Ɯ ɯ	f*oo*l
E e	m*e*t	O o	c*o*t	Ʊ u	f*u*ll
Æ æ	m*a*re	Ų ų	h*ea*rd	Ʉ ų	n*ew*s

COMPOUND VOWELS.

Ɨ ɨ	hi*gh*	Ф ô	ho*y*	Ȣ ȣ	ho*w*

"Some objections which are made to the project of reform ought to be considered.

"1. It is feared by many that if the new mode of printing should prevail, all the libraries now in existence will become useless. This fear is entirely groundless. When a knowledge of the language, or facility in reading, is once acquired through phonotypy, it will be perfectly easy to read books printed in the common type; far more easy than it is for us to read old black-letter English, or the English of the times of Chaucer. It will probably take less time, — I have no doubt myself that it will take much less time, — to read phonotypically first and heterotypically afterwards, than to learn to read by the common mode alone; inasmuch as, when one has learnt the phonotypic alphabet, he may learn to read of himself without farther assistance, the letters giving necessarily the true sounds of the words, and, the knowledge of the words of the language once acquired, one may, afterwards, soon read them with ease, however disguised by a barbarous heterography.

"2. It is objected that it will, if adopted, oblige all of us to learn a

considerable portion of a new alphabet. Let any one who feels this objection make the attempt, for only two hours, to read a well printed phonotypic book, and the objection will disappear. When the art of writing was first introduced among the Anglo-Saxons, the art of deciphering it was well called *reading*, that is *guessing*. Reading English is a sort of guessing at the meaning of hieroglyphical symbols; and so admirably are we all trained to the art by learning to read, that any one will find it surprisingly easy to guess at the power of all the newly introduced letters of the phonotypic alphabet, without looking into a *First Book* for them. This statement, which I believe is literally true of the small letters, may, perhaps, admit of an exception in regard to the capitals, when found in a line by themselves. The new letters are carefully selected, as has been already stated, to represent those sounds which least frequently occur; and in assigning them characters, forms have in most instances been chosen with which we are already familiar or which resemble the letters whose power they most nearly represent.*

"3. A third objection which is urged against the reform is, that by changing the spelling we are in danger of losing sight of the derivation of a word, and thus of losing one clew to its meaning. Let Dr. Franklin answer this objection, as it was made to him originally by a correspondent.† 'Now as to the inconveniences you mention; the first is, "that all our etymologies would be lost, consequently we could not ascertain the meaning of many words." Etymologies are *at present* very uncertain, but such as they are, the old books would still preserve them, and etymologists would there find them. Words in the course of time change their meanings, as well as their spelling and pronunciation; and we do not look to etymologies for their present meanings. If I should call a man a knave and a villain, he would hardly be satisfied with my telling him that one of the words originally signified only

* The sound of *ee* in feet is represented by a letter which is nearly the italic *i*; *a* in date and *a* in psalm are represented by common forms of our written *e* and *a*; *au* in caught by ɵ; *u* in cur, by ɥ, *u* lengthened, the sign proposed by Dr. Franklin; *o* in grow, by o, and *oo* and *u* in fool and full by ɯ, u, two *u*'s combined; *ew* as heard in yew, the name of a tree, by ɥ; *oy* in boy, by ȯ, *o* with a contracted *y* above it; *ch* in etch by ç, which it most nearly resembles; *th* in loath, by one form of *t*, ŧ; *th* in loathe by đ, *d* and *t* combined; *sh* in mesh, by a long *s*, ʃ; *zhe* in measure, by a written *z*, ʒ; and *ng* by a sign suggested by Dr. Franklin, ŋ, *n* with the last part of *g* combined with it.

† Miss Stevenson.

a lad or servant, and the other an under ploughman or the inhabitant of a village. It is from present usage only the meaning of words is to be determined.' To this answer may be added, that phonography will probably accompany phonotypy, and that when words from different languages are written, side by side, in the letters of an alphabet of signs formed on philosophical principles, as those of phonography are, a multitude of derivations will reappear which had been long buried out of sight under the barbarous and fantastic ruins of exploded heterographical spellings.*

"4. A fourth objection may be stated, with its answer, in the words of Dr. Franklin. 'Your second inconvenience is, "that the distinction between words of different meaning and similar sound would be destroyed." That distinction is already destroyed in pronouncing them; and we rely on the sense alone of the sentence to ascertain which of the several words, similar in sound, we intend. If this is sufficient in the rapidity of discourse, it will be much more so in written sentences, which may be read leisurely, and attended to more particularly, in case of difficulty, than we can attend to a past sentence, while the speaker is hurrying us along with new ones.'

"The existing forms of letters have been retained to represent those sounds which they are found, after an extended numerical analysis, to stand for most frequently in the present alphabet. This fact renders the change in the appearance of phonotypical printing as small as possible, and the difficulty of reading it the least possible; so that any person accustomed to read our language as now printed may at once read phonotypical printing without difficulty, and in an hour or two read it fluently. The advantages following from the adoption of this reformed alphabet will be very great.

"1. It may be acquired in one fifteenth part of the time necessary for the present.†

"2. When acquired, it leads the learner to the correct pronunciation of every word which he meets with.

* This fact, very strikingly proved by writing phonographically words in different languages from the same root, gives satisfactory evidence of the truth of a principle admitted by Archdeacon Hare: — "The common pronunciation of a word frequently agrees better than its spelling with its etymology and analogy."

† A writer in *Chambers's Edinburgh Journal* says one twentieth the time. A child has now, instead of the mere alphabet, to learn nearly all the words of the language, as if they were represented by separate hieroglyphics.

"3. It dispenses entirely with the difficult, and to most persons impossible, acquisition of learning to spell. A knowledge of the just sound suggests infallibly the true spelling, and the spelling, with equal certainty, the correct pronunciation.

"4. By the omission of silent letters, it renders reading one fifth part more rapid than at present.

"5. It will render the acquisition of reading and spelling attainable to millions, to whom it is now unattainable.

"6. It will enable a writer to represent any proper name or word of an unknown language in such a manner as to be read by a stranger with precisely the same pronunciation which the writer gives it, inasmuch as variations of sounds are made visible to the eye.

"7. It will tend to banish provincialisms,* as each written word suggests its correct pronunciation.†

"8. By representing the long and short vowels by different letters, it renders possible the adoption of a few perfectly simple and comprehensive rules of accent, a thing which, up to this time, has been nearly wanting in the language."

William S. Sullivant, Esq., communicated to the Academy, through the Corresponding Secretary, a paper entitled, "Contributions to the Bryology and Hepaticology of North Ameri-

* Dr. Franklin used to regret that there was not something like a phonotypic dictionary in existence in his day, as it would, he said, have enabled him, when in England, to avoid the peculiarities of American pronunciation.

† In order that it may have this effect, the books printed phonotypically must give the received pronunciation of the best speakers in England. This is a matter of the greatest importance; and America looks to England for a guidance in this respect which may be safely followed. Peculiarities of speech — provincialisms — are growing up and strengthening in all parts of our country; and although this cannot probably be prevented for the mass of the people, who learn the language only from the ear, it may for the educated part of the community. Phonotypy offers the means of rendering the pronunciation of well educated people nearly uniform, wherever the language is read and spoken. But in order to do this, it must be under the direction of persons who have, all their lives, been accustomed to hear the language spoken in its purity. Peculiarities of particular districts of the mother country are as much to be avoided as provincialisms or Americanisms. This point has not received the attention it deserves from the editors of the *Phonotypic Journal;* and it would not be difficult to point out in their pages instances of pronunciation which would, even in New England, be considered as decidedly inaccurate, and sometimes vulgar.

ca," with drawings, illustrating the following species, namely, *Phyllogonium Norvegicum*, Brid. (recently detected in Ohio); *Fissidens minutulus*, Sulliv.; *F. exiguus*, Sulliv.; *Schistidium serratum*, Hook. & Wils.; *Aneura sessilis*, Sulliv.; *Marchantia disjuncta*, Sulliv.; *Notothylas valvata* and *N. orbicularis*, Sulliv.

Dr. Holmes, from the committee appointed at the meeting in March to report upon the case of Henry Safford, the young Vermont mathematician, stated, that, at the request of Professor Peirce, the drawing up of a full report had been deferred until the arrival of the boy in this vicinity, where he is expected to reside. Some interesting statements were made by Professor Peirce, from which it would appear that the mere calculating faculty is not by any means as remarkable in him as it was in Zerah Colburn, but that it is rather incidental, as a part of extraordinary reflective powers.

S. P. Andrews, Esq., of Boston, and George Engelmann, M. D., of St. Louis, Missouri, were elected Fellows of the Academy.

The following were elected Foreign Honorary Members of the Academy, viz.: —

Prof. Louis Agassiz, of Neuchatel, Switzerland.

M. Edouard de Verneuil, of Paris.

M. Joseph Decaisne, Professor at the Jardin des Plantes, Paris.

DONATIONS TO THE LIBRARY,

FROM MAY TO AUGUST, 1846.

Jomard. Seconde Note sur une Pierre gravée trouvée dans un Ancien Tumulus Americain. 8vo. pamph. Paris, 1845. From the Author.

Catalogue of Stars, made under the Direction of the British Association for the Advancement of Science. 4to. London, 1845. From the Association.

Address at the Inauguration of the Honorable Edward Everett, as

President of the University in Cambridge. 8vo. pamph. Boston, 1846. From President Everett.

Collections of the Massachusetts Historical Society. Vol. IX. 8vo. Boston, 1846. From the Society.

Mémoires de l'Académie Imperiale des Sciences de St. Petersbourg. 6me Serié. — Sciences Naturelles, Tom. II., livr. 4–6, and Tom. IV., livr. 6. 1838 & 1845. — Sciences Politiques, etc., Tom. IV., livr. 3, and Tom. V., livr. 5, 6. 1838 & 1845. — Sciences Mathematiques et Physiques, Tom. I., livr. 5, 6, Tom. II., livr. 1, 2, and Tom. III., livr. 4–6. 1838 & 1844. From the Imperial Academy.

Mémoires presentés à l'Académie Impériale des Sciences de St. Petersbourg, etc., Tom. III., livr. 1–6. 1837. Tom. IV., livr. 6. 1845. From the Imperial Academy.

Recueil des Actes de la Séance Publique de l'Académie Impériale des Sciences de St. Petersbourg, tenue le 29 Déc. 1844. 4to. St. Petersbourg, 1845. From the Imperial Academy.

Dr. S. G. Morton. Observations on the Ethnography and Archæology of the American Aborigines. 8vo. pamph. New Haven, 1846. From the Author.

Fifty-ninth Annual Report of the Regents of the University of the State of New York. 8vo. Albany, 1846. From Dr. A. Gray.

Lieutenant Gillis. Astronomical Observations made at the Naval Observatory, Washington. (Congressional Document.) 8vo. Washington, 1846.

Abhandlungen der Math.-Phys., Classen der Koenigl. Bayerschen Akademie der Wissenschaften, München. Vols. XIII., XVI., and XIX. (1837–1845.) 4to. Munich. From the Bavarian Academy.

Bulletin der Koenigl. Bayersch. Akad., etc. No. 1–52, for 1845. No. 1–5, for 1846. 4to. From the Academy.

Gehlehrte Anzeigen. Vols. XVI.–XIX., inclusive. 4to. Munich. From the Bavarian Academy.

Almanach der Koenigl. Bayersch. Akad., etc. 1844, 1845. Munich. From the Academy.

J. P. Von Spix and *C. F. P. Von Martius.* Reise in Brasilien, etc. 3 vols. 4to. Munich, 1823–31. From Professor Von Martius.

Martius. Systema Materiæ Medicæ Vegetabilis Brasiliensis. 12mo. Leipsic, 1843. From the Author.

Martius. Die Kartoffel Epidemie. 4to. pamph. Munich, 1842. From the Author.

Dr. P. F. Von Walther. Rede zum Andenken an Dr. Ignatz Döllinger. 4to. pamph. Munich, 1841. From Professor Von Martius.

Dr. F. Döllinger. Gedachtnissrede auf S. T. Von Sömmering. 4to. pamph. Munich, 1830. From Professor Von Martius.

Dr. F. Lamont. Ueber des Magnetische Observatorium. 4to. pamph. Munich, 1833. From the Author.

Professor J. G. Zuccarini. Ueber die Vegetationsgruppen in Bayern. 4to. pamph. Munich, 1833. From the Author.

Dr. A. Wagner. Andentungen zur Charakteristik des Organischen Lebens. 4to. pamph. Munich, 1845. From the Author.

Annals of the Lyceum of Natural History. New York. Vols. I.–III., and Vol. IV., fasc. 1–7. 1844–46. 8vo. New York. From the Lyceum.

Chart of the Harbour of Annapolis, and Chart of the Harbour of New Bedford. United States Coast Survey, A. D. Bache, Superintendent. From the Treasury Department.

Two hundred and eighty-sixth Meeting.

October 28, 1846. — Special Meeting.

The Academy met at their Hall, previous to adjourning to King's Chapel to hear the Eulogy of the Hon. Daniel A. White upon their late President.

Messrs. G. B. Emerson, Gould, Greene, and the President, were appointed a committee to arrange the monthly meetings for the coming season.

Two hundred and eighty-seventh Meeting.

November 3, 1846. — Monthly Meeting.

The President in the chair.

The thanks of the Academy were voted to the Hon. Daniel A. White, for his able, discriminating, and faithful delineation of the character of our late admired and much lamented President, and that a copy of the discourse be requested for the press.

Dr. Henry J. Bigelow gave some account of a new process of inhalation employed by Dr. Morton, of Boston, to produce insensibility to pain during the performance of operations by the dentist and the surgeon.

Two hundred and eighty-eighth Meeting.

November 12, 1846. — QUARTERLY MEETING.

The PRESIDENT in the chair.

The President announced that the new volume of the Academy's Memoirs was ready for distribution to the Fellows.

The Corresponding Secretary read a letter from M. Edouard de Verneuil, of Paris, acknowledging and accepting his election as a Foreign Honorary Member of the Academy. Dr. George Engelmann, of St. Louis, Missouri, and Dr. Elisha Bartlett, of Lowell, likewise accepted their election as Fellows.

Professor Peirce communicated the elements of an elliptic orbit of De Vico's fourth comet, which he has computed, by the method of least squares, from all the observations made by Mr. Bond, combined with De Vico's observation of the 20th of February, the Paris observations of the 2d, 5th, and 6th of March, and the Hamburg and Altona observations of the 12th and 15th of March.

"Time of perihelion passage, March $5^{d}.54775$, Greenwich M. S. T.
Longitude of perihelion, $90° 27' 18''.8$, Mean Equinox 1846.0.
" ascending node, $77° 33' 26''.3$, " "
Inclination, $85° 6' 12''.3$.
Perihelion distance, 0.663735.
Eccentricity, 0.9622465.
Semi-major axis, 17.58075.
Period of sidereal revolution, $73^{y}.715$.
Motion direct.

"The comparison of this orbit with observation gives the following differences between the observed and computed places.

Greenwich Mean Solar Time of Observation.	Comet's observed true R. A.	Comet's observed true Dec.	Ex. of obs'd over comp. R. A. cos. Dec.	Ex. of obs'd over comp. Dec.	Observer.
d.	° ′ ″	° ′ ″ (S.)	″	″	
Feb. 20.26993	14 28 48.2	7 29 23.0	+ 9.4	+ 28.3	De Vico.
" 26.53907	15 6 29.5	(N.) 3 19 16.7	+ 19.0	— 10.4	Bond.
March 1.28629	15 9 13.2	7 47 32.3	— 41.1	— 4.3	Santini.
" 1.51397	15 8 13.3	8 8 34.6	— 4.8	— 22.3	Bond.
" 2.31774	15 7 13	9 24 34	+ 2.5	— 5.5	Laugier.
" 2.51017	15 6 36.3	9 42 34.4	— 11.5	— 3.5	Bond.
" 3.29356	15 5 1.2	10 55 5.7	+ 10.1	+ 1.6	Santini.
" 3.30060	15 4 58	10 55 49	+ 10.2	+ 7.4	Carlini.
" 3.50166	15 4 12.9	11 13 36.9	— 0.2	+ 15.5	Bond.
" 4.51907	15 0 29.9	12 46 6.0	+ 1.5	— 6.1	Bond.
" 5.32380	14 56 48	13 57 34	+ 3.5	— 5.1	Laugier.
" 5.55586	14 55 27.7		+ 4.2		Bond.
" 6.29348	14 51 8	15 22 10	— 13.1	— 0.8	Laugier.
" 6.54053	14 49 38.8	15 43 24.3	— 2.7	+ 0.2	Bond.
" 7.28305	14 45 4.5	16 46 33.3	+ 11.2	— 3.7	Santini.
" 9.49542	14 26 58.6	19 48 47.9	— 3.1	+ 6.7	Bond.
" 10.50852	14 17 18.9	21 8 58.1	+ 5.6	+ 1.4	Bond.
" 11.27924	14 9 21.5	22 9 13.4	— 3.6	+ 27.3	Santini.
" 11.51920	14 6 55.0	22 27 33.2	+ 11.5	+ 24.6	Bond.
" 12.27386	13 58 43.4	23 24 28.1	+ 15.0	+ 8.8	Santini.
" 12.30868	13 58 5.5	23 26 56.3	+ 1.5	+ 2.9	Rümker.
" 12.31213	13 58 3.6	23 26 53.2	+ 0.4	— 2.3	Petersen.
" 12.50815	13 55 32.4	23 41 44.1	+ 4.7	— 5.1	Bond.
" 13.25971	13 46 53.0	24 27 32.4	+ 2.5	+ 6.7	Santini.
" 15.31012	13 20 14.6	27 3 54.1	— 4.7	— 2.9	Rümker.
" 15.31410	13 20 16.1	27 4 5.5	— 0.4	— 8.2	Petersen.
" 16.28382	13 6 33.9	28 11 1.1	— 9.6	— 0.4	Santini.
" 17.30947	12 51 48.6	29 19 54.1	— 2.3	— 2.5	Rümker.
" 17.32066	12 51 36.8	29 20 44.4	— 2.0	+ 1.4	Petersen.
" 17.32332	12 51 37.5	29 20 57.5	+ 0.6	+ 3.8	Challis.
" 17.51552	12 48 37.4	29 33 43.5	+ 3.5	+ 13.8	Bond.
" 18.54634	12 32 59.5	30 41 3.0	+ 2.8	+ 8.0	Bond.
" 20.28267	12 5 7.5	32 30 54.5	— 1.2	+ 17.1	Rümker.
" 20.33603	12 4 10.9	32 34 11.9	— 2.8	+ 17.9	Challis.
" 21.35047	11 47 15.1	33 35 37.5	— 1.6	— 17.9	Schmidt.
" 21.36716	11 47 2.3	33 37 3.6	+ 1.8	+ 7.6	Argelander.
" 21.55586	11 44 23.9	33 45 30.5	— 6.8	— 5.0	Bond.
" 22.28800	11 31 6.9	34 32 19.8	— 2.1	+ 19.4	Littrow.
" 23.32120	11 12 50.2	35 32 33.4	— 4.8	+ 4.9	Rümker.
" 23.32445	11 12 43.6	35 32 42.8	— 6.4	— 2.1	Kaiser.
" 24.30787	10 55 4.4	36 29 7.2	— 2.3	+ 8.6	Petersen.
" 24.31499	10 55 9.7		+ 8.5		Littrow.
" 24.38502	10 53 37.4	36 33 20.9	— 3.6	— 1.2	Challis.
" 27.31119	9 58 42.9	39 14 20.2	+ 7.3	+ 6.1	Rümker.
" 30.34197	8 58 0.8	41 52 4.0	— 1.6	+ 11.0	Rümker.
" 31.29079	8 38 31.6	42 39 47.3	+ 5.5	+ 10.1	Littrow.
" 31.31750	8 38 14.3	42 41 8.7	+ 17.3	+ 10.4	Rümker.

Greenwich Mean Solar Time of Observation.		Comet's observed true R. A.			Comet's observed true Dec. N.			Ex. of obs'd over comp. R. A. × cos. Dec.	Ex. of obs'd over comp. Dec.	Observer.
	d.	°	′	″	°	′	″	″	″	
Mar.	31.32949	8	37	40.4	42	41	35.3	+ 3.4	— 2.4	Kaiser.
"	31.52451	8	33	49.8	42	51	33.1	+ 17.3	+ 17.0	Bond.
April	1.33315	8	16	36.6	43	31	16.2	+ 7.7	+ 2.6	Argelander.
"	1.33531	8	16	5.5	43	31	25.8	— 12.5	+ 5.8	Schmidt.
"	1.33952	8	16	20.3	43	31	25.8	+ 2.3	— 6.4	Rümker.
"	1.52523	8	12	23.0	43	40	51.8	+ 4.0	— 8.8	Bond.
"	2.32372	7	55	16.1	44	19	39.3	+ 5.3	+ 5.8	Schmidt.
"	2.33197	7	54	51.1	44	20	2.8	— 4.9	+ 4.8	Argelander.
"	2.34457	7	54	42.4	44	20	37.0	+ 0.6	+ 3.3	Argelander.
"	2.54317	7	50	11.6	44	30	1.6	— 5.5	— 10.2	Bond.
"	3.88118	7	20	23.6	45	34	18.8	— 18.8	+ 5.8	Bond.
"	5.34286	6	48	6.3	46	42	55.3	+ 13.5	+ 0.4	Argelander.
"	5.36738	6	47	23.6	46	44	6.1	+ 6.9	+ 3.3	Schmidt.
"	13.37251	3	24	50.5	52	42	37.8	— 15.7	+ 7.4	Schmidt.
"	14.55262	2	51	53.6	53	33	34.0	+ 10.0	+ 4.0	Bond.
"	15.56862	2	21	58.8	54	17	3.9	+ 4.5	+ 0.1	Bond.
"	16.37364	1	57	49.4	54	51	21.6	+ 4.5	— 0.6	Rümker.
"	16.54491	1	53	1.4	54	58	57.5	+ 27.0	+ 15.5	Bond.
"	18.36677	0	54	10.8	56	16	5.1	— 8.0	+ 22.7	Rümker.
"	21.41859	359	8	40.7	58	23	37.2	+ 15.1	+ 12.2	Argelander.
"	21.50639	359	5	0.4	58	27	13.3	+ 1.9	+ 10.8	Schmidt.
"	23.35969	357	53	57.2	59	43	54.0	+ 15.5	+ 9.4	Argelander.
"	23.36455	357	53	10.3	59	44	7.9	+ 3.4	+ 9.3	Schmidt.
"	25.37553	356	28	40.4	61	6	36.7	+ 4.2	+ 4.6	Schmidt.
"	27.39316	354	55	29.4	62	28	42.3	+ 13.7	+ 6.4	Argelander.
"	27.84383	354	32	47.5	62	47	5.2	+ 11.7	— 4.7	Bond.
"	28.45705	354	2	29.4	63	11	33.9	+ 24.1	— 1.1	Argelander.
"	29.48934	353	7	26.6	63	53	8.4	+ 10.3	+ 12.8	Argelander.
May	1.51532	351	10	16.4	65	13	48.5	— 1.8	+ 29.6	Argelander.
"	4.82418	347	27	56.3	67	21	17.8	+ 5.2	— 24.8	Bond.
"	18.64778	320	11	42.2	74	35	38	— 10.3	— 15.4	Bond.
"	19.66111	317	14	39.2	74	54	17	+ 36.9	— 69.9	Bond.

Mr. Peirce is collecting observations preparatory to a still more thorough investigation of the orbit of this comet, and desires communications from those astronomers who may have observed it.

Professor Peirce said that his attention had been drawn, by Mr. Herrick of New Haven, to the supposed planet observed by Wartman of Geneva, in 1831, with the inquiry, whether it was not identical with Le Verrier's. He showed, that, although it could not have been more than eight or ten degrees distant

from it, it was too far from the place given by Le Verrier's orbit to be the same body, and that the limits of the errors of this orbit were much too small to be consistent with their identity. He showed, moreover, that the places of the body given by Wartman's observations are wholly irreconcilable with those of any planet whatever, whose orbit is nearly circular, and whose motion is direct. The researches made by Wartman, in the year 1832, for the rediscovery of his supposed planet, might easily have resulted in the discovery of the planet by which the name of Le Verrier is now immortalized.

Donations to the Library.

Annual Report of the Commissioner of Patents, for 1845. 8vo. Washington, 1846. (Cong. Doc.) From Hon. R. C. Winthrop.

Report of the Fifteenth Meeting of the British Association, held at Cambridge, in June, 1845. 8vo. London, 1846. From the British Association.

Annuaire Universel au Histoire Politique pour 1844. 8vo. Paris, 1845. From O. Rich.

Sir R. I. Murchison. Address to the British Association for the Advancement of Science. 8vo. pamph. London, 1846. From E. Everett.

Gaspar Cipri. Découvertes Physico-Mécaniques. 8vo. pamph. Paris, 1846. From the Author.

Antiquissimi Virgiliani Codicis Fragmenta et Pictura ex Bibliotheca Vaticana. fol. Roma, 1742. Bequest of Hon. John Pickering.

A. A. Gould. Expedition Shells: described for the Work of the U. S. Exploring Expedition. 8vo. pamph. Boston, 1846. From the Author.

Abhandlungen der Koeniglichen Akademie der Wissenschaften zu Berlin. For 1844. 4to. Berlin, 1846. From the Berlin Academy.

Besicht über die zur Bekanntmachung geeigneten Verhandlungen der K. Preuss. Akad. Wissenschaften zu Berlin. July, 1845, to June, 1846. 8vo. From the Berlin Academy.

Nouveaux Mémoires de l'Académie Royale des Sciences et Belles-lettres de Bruxelles. Tom. XVII. & XVIII. (1844, 1845). 4to. From the Academy.

Mémoires Couronnés et Mémoires des Savants Étrangers publiés

par l'Académie Royale des Sciences et Belles-lettres de Bruxelles. Tom. XVII. & XVIII. (1843 – 1845). 4to. From the Academy.

Bulletins de l'Académie Royale des Sciences, etc., de Bruxelles. Tom. XI. & XII. (for 1844, 1845). 8vo. From the Academy.

Annuaire de l'Académie Royale des Sciences, etc., de Bruxelles. For 1844 and 1845. From the Academy.

Annales de l'Observatoire Royale de Bruxelles. Publiés aux frais de l'État, par le Directeur, A. Quetelet. Tom. IV. 4to. 1845. From M. Quetelet.

Observations des Phénomènes Periodiques. (Extr. du Tom. XVII. des Mem. Acad. Brux.) 4to. From M. Quetelet.

Two hundred and eighty-ninth Meeting.

December 1, 1846. — Monthly Meeting.

The Vice-President in the chair.

Dr. C. T. Jackson exhibited specimens of gun-cotton, explained the mode of preparation, and illustrated its effects. He also exhibited specimens of paper prepared in a similar way, which was shown to acquire nearly the firmness of vellum, and to have become somewhat impermeable to water.

Mr. Agassiz made some remarks on the points of resemblance between the flora of the fresh-water *Molasse* (later miocene) of Europe and the existing flora of North America, alluding to the fossil fruits, &c., in the former of such peculiarly North American genera as *Taxodium*, *Liquidambar*, *Carya*, etc., and to a considerable prevalence of *Juglandeæ*, as facts not only very curious in themselves, but also as evidence that Europe, at the era in question, possessed a temperate (and not a tropical) climate.

Dr. Webster communicated from Mr. Hunt, the British Consul at St. Michaels, Azores, the annexed table, containing the results of his meteorological observations made at that place.

TABLE

Showing the Mean Temperature, Dew-point, Dryness, and Atmospheric Saturation, according to the Prevalence of particular Winds; the Results of Observations taken at St. Michaels, in 1845 and 1846.

By J. C. Hunt, Esq., *H. B. M. Consul at St. Michaels, Azores.*

N. B. The observations were taken daily, at intervals of three hours. Results in small figures not verified.

	Mean Temperature. Therm. Ext. North, exp. shade.									Mean Dew-point. By Wet Thermometer, near the other.*								
1845.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Mean	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Mean
Jan.	0	55	0	57	58.5	59	59	58	58.5	0	52	0	54	54	56	56	53	53.2
Feb.	55	54	50	56	58	59	0	54	57.8	51	51	48	53	54	56	0	52	52.7
Mar.	60	57	56	59	62	62	61	61	59.3	57	50	50	53	55	57	56	55	52.6
April	59	62	0	63	63	62	62	60	61.6	57	55	0	56	55	56	57	55	54.3
May	62.9	61.8	65.6	65.3	67.1	69 7	67	63 2	63 9	53.9	51.9	58.4	58.9	62 2	58.5	66.8	56.4	155.
June	0	69	0	70.3	71.8	71.5	72.8	70.4	69 8	0	57 –	0	58 –	57.9	60.8	62 7	61.0	59 5
July	73.2	75.5	0	75 –	76–	73 2	70.8	0	74.5	65 8	64.3	0	64.4	67.8	64 5	60.3	0	63.1
Aug.	0	76.2	0	76 7	0	77.7	70	72 2	76.4	0	63.2	0	64.5	0	65 9	58 8	61.8	63.9
Sept.	67.5	69.4	66.6	68.8	0	72 1	71 1	70.5	69.5	55 8	58 7	60.1	60.5	0	64	60.3	55 2	59
Oct.	59.5	64.5	63	65	0	64	0	64	64 5	55.5	55.5	56.5	57	0	60	0	56	57.5
Dec.	58	56.5	56	59	58.5	58 5	50.5	56	57	51.5	51	51	53	50.5	52	46 5	46	51.5
Nov.	57.5	58	58.5	63.5	0	63.5	60	59	59 5	51 5	52	50	57	0	59	56	53	54
Year's Mean,	60.9	63.2	59.4	64.9	62.9	65.2	64.4	62.6	64 4	55.8	55.2	52.7	57.4	57	59.2	57.3	54 9	56.3
Jan.	55	55.5	56	58.5	59	59 5	58.5	57.5	58 5	54	51.5	54	53.5	55	55.5	54.5	52 5	54
Feb.	0	56	49.5	60	59	59	58	55	58	0	50	46	54	55	55	53	50	53.5
Mar.	61	56.5	56.5	59	63	61	60.5	59.5	60	58	48.5	50	53	58	57.5	55 2	54	55
April	58	61.5	60	64	63	61.5	61.5	59	61	56	55 5	54	56.5	55 5	57	56.5	53	55
May	66.5	63	64	63	67	67	65	65	64	58	55.5	58.5	58	59.5	57.5	58	57	56.5
June	73	68.5	68	71	70.5	72	68	70	71	59	57	63.5	61	59.5	62.5	60.5	58	61.5
July	69.5	72	77.5	80.5	0	73.5	72.5	75	73.5	60	60	67	56	0	64 5	61 5	64.5	63

	Mean Dryness. Difference between the Thermometers.									Vapor-grains in a cubic foot of air.								
1845.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Mean	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Mean
Jan.	0	3	0	3	2.5	3	3	5	5.3	0	4.44	0	4 74	5.05	5 04	5.04	4.57	4.56
Feb.	4	3	7	3	4	3	0	2	5.1	4.30	4.31	3.28	4.59	4.73	5.04	0	4.45	4.70
Mar.	3	7	6	6	7	5	5	6	6.7	5.21	4.14	4.15	4.56	4.55	5.19	5.02	4.86	4.49
April	2	7	0	7	8	6	5	5	7.3	5.22	4.85	0	5.00	4.84	5.01	5.19	4.86	4.82
May	9	9 9	7.2	6.4	4.9	11.2	10.2	6.8	8.4	4 68	4.38	5.41	5.60	6.21	5.38	5.14	5.08	5.01
June	0	12.2	0	12.2	13.9	10.8	10 –	8.6	10.7	0	5 18	0	5.37	5.26	5.77	6 20	5.95	5.56
July	7.5	14	0	12	8.5	10.5	10.5	0	11 4	6.79	6 77	0	6 48	7.22	6.52	5.73	0	6.30
Aug.	0	3	0	13 2	0	11.8	11.3	10.5	12.5	0	6.17	0	6.63	0	6.83	5.21	6.34	6.40
Sept.	11.8	11.1	11.4	7.7	0	8.1	10.5	10.4	10.5	4.92	5.46	4.86	5.89	0	6·43	5.77	5.68	5 54
Oct.	4.5	9	13.5	11	0	6.5	0	4.5	7.0	4.92	4.95	5.26	5.18	0	5.59	0	5.08	5.21
Dec.	3	3	5 5	6.5	8	6	3.5	7.5	5.5	4.61	4.45	4.25	4.56	4.09	4.48	3 91	3.94	4.32
Nov.	7	7	8.5	7	0	5.0	4	5 5	5.5	4.35	4.43	4 13	5.13	0	5.42	5.08	4.57	4.68
Year's Mean,	5.1	8	6.7	7.5	5.9	6	7.1	7.7	8.1	5.00	4.96	4.47	5.31	5.25	5.56	5.23	5.03	5.13
Jan.	1	4	2	5	4	4	4	5	4.5	4.76	4.34	4 75	4.66	4 91	4.91	4.78	4.52	4.76
Feb.	0	6	3.5	6	4	4	5	5	4.5	0	4.12	3 61	4 64	4.90	4.90	4.59	4.13	4.66
Mar.	3	8	6.5	6	5	3.5	5	5.5	5	5.33	3.92	4.13	4 57	5.35	5.27	4.92	4.76	4.84
April	2	6	6	7.5	7.5	4.5	5	6	6	5.05	4.94	4.73	5.05	4.89	5.20	5.11	4.57	4.88
May	8.5	7.5	5.5	5	7.5	10	7	8	7.5	5.23	4.98	5 28	5.16	5.56	5 21	5.30	5·13	5.11
June	14	11.5	4.5	10	11	9.5	7.5	12	10.5	5.42	5.13	6 41	5.84	5.57	6.12	5.73	5.33	5.76
July	9 5	12	10.5	24.5	0	9	11	10.5	11	5 63	5.66	7 02	4.86	0	6.46	6.0	6 47	6.10

* Dew-point found in multiplying the difference between the thermometers by 2.33.

Mr. Hunt remarks upon these results, that

"The table bears out the general experience at St. Michaels, that the southwest wind brings most moisture, and that it is followed in the order of humidity by the cardinal points, west, north, and east. During the six years ending with December 31st, 1845, the mean of twenty-five days was north, 111 northeast, 18 east, 42 southeast, 17 south, 52 southwest, 74 northwest, and 8 perfectly calm, which numbers, multiplied by their respective mean annual amounts of vapor, and divided by 365, give a mean of five grains of vapor for the whole year. As might be expected, there is more vapor in summer than in winter. The thermometer rose to the extraordinary height this month (August, 1846), on three different days, of 90° F., and the vapor only amounted to 6.65, which is less than with the thermometer at 75°."

Mr. S. P. Andrews stated that he had in course of preparation a memoir on the Chinese language, according to the request of the committee of the Academy upon that subject; and that he should also, at an early day, be prepared to present and explain before the Academy detailed charts of Chinese syllabic or sound words, with their ramified significations, in illustration of the theory he maintained. Mr. Andrews farther stated, in brief, that he believes that he shall be able to demonstrate conclusively that

"All the numerous meanings of the same vocal syllable or word in the Chinese language, being in some instances as many as several hundreds, and seeming at first view to have no connection with each other, are in fact legitimately and closely related in *idea*; in other words, that all of these numerous significations constitute a family of ideas, which family is denoted *generically* by the single Chinese word, while they are severally or *specifically* signified in other languages by a *family of words*, which then have corresponding *etymological* relationships; — hence, that *ideas* are distributed into *genera* and *species*, and that a true and thorough insight into the structure of the very remarkable spoken language of China conducts directly to a knowledge of this distribution, and of the laws by which it is governed. From this it seems to result, that, out of the philosophical study of the Chinese will issue a light which cannot fail to illuminate the whole field of etymology, and,

finally, to lay open the complete science of language. The investigation of language from its central dominion of thought outward, into the department of words as its vocal manifestations, will constitute the most important epoch in philology. Out of this change in the mode of conducting the study will result a systematized comparative philology, universal in its scope, by the aid of which the acquisition of tongues will be greatly facilitated.

"In contradistinction from the Phonetic theory," Mr. A. maintains, "that the principle above stated in relation to the meanings of the Chinese spoken words has governed the selection of the written characters chosen to represent those meanings, and thus will furnish a complete solution of the great problem of the Chinese written system; and also, that the Chinese is etymologically related to the European stock of languages, and that its relation to the Teutonic family of languages is one of special nearness."

Professor Gray communicated the characters of some new genera and species of Compositæ from Texas, as follows.

"VERNONIA LINDHEIMERI (*Gray & Engelm., Pl. Lindh. ined.*): foliis anguste linearibus confertis sessilibus uninerviis margine revolutis supra glabris punctatis subtus cauleque simplici sericeo-tomentosis; capitulis corymbosis breviter pedunculatis 30–40-floris; squamis involucri cano-tomentosi pappo rubiginoso brevioribus conformibus appressis oblongis obtusis exappendiculatis; achæniis glabris 10-costatis glandulosis; pappo exteriori multisquamellato. — In rupestribus prope *New Braunfels*, Texas, legit *Lindheimer*. — Perennis, bipedalis: folia bipollicaria: capitula semiuncialia.

"AGERATUM (subgen.? MICRAGERATUM; involucrum subbiseriale fere Sclerolepidis, pappus coroniformi-multisquamellatus nunc 5-aristulatus) WRIGHTII (*Torr. & Gray, Fl. ined.*): diffuso-ramosissimum, hirsutulum; foliis oppositis alternisve lanceolato-oblongis e basi cordato sessili parce dentatis; capitulis subglobosis (50–60-floris); pedunculis filiformibus. — Prope flumen Colorado Texas legit *C. Wright*. — Spithamæa, ramis plurimis e caule repente. Variat 1. pappi squamellis setiformibus basi subconnatis tubo corollæ plus duplo brevioribus; 2. squamellis 5 angulis achænii respondentibus in aristis tubum corollæ æquantibus productis.

"BRICKELLIA (BULBOSTYLIS) CYLINDRACEA (*Gray & Engelm., Pl.*

Lindh. ined.): cinereo-pubescens et resinoso-atomifera, herbacea; foliis plerisque oppositis triplinerviis subtus reticulato-venosis oblongo-ovatis obtusiusculis grosse serratis brevissime petiolatis, ramealibus subsessilibus; capitulis pedunculatis in paniculam foliosam laxe corymbosam digestis; involucri 10-flori cylindrici squamis 4-seriatim imbricatis arachnoideo-ciliatis striatis mucronato-acuminatis, intimis linearibus pappum barbellato-serrulatum æquantibus, exterioribus multo brevioribus ovalibus appressis; achæniis puberulis. — In declivibus fluv. Guadaloupe Texas, ultra New Braunfels, *Lindheimer*. Affinis B. Cavanillesii.

"LINDHEIMERA, *Gray & Engelm.*, *Pl. Lindh. ined.*

(Secionideæ-Melampodineæ.)

"Capitulum multiflorum monoicum; fl. radii 4 – 5 ligulatis, fœmineis, ad axillas squamarum invol. interiorum sitis; fl. disci circiter 20 tubulosis, sterilibus. Involucrum duplex, exterius e squamis 4 – 5 laxis linearibus foliaceis, interius totidem membranaceo-foliaceis oblongis planis disco longioribus. Receptaculum planum, paleis chartaceis ovariis sterilibus amplectentibus onustum, binis exterioribus basi cujusque squam. inter. invol. adnatis, persistentibus. Ligulæ ovales, breviter tubulatæ, involucrum vix superantes: corolla disci 4 – 5-dentata. Styli fl. ster. filiformes, indivisi, hispidi. Achænia radii ovalia, obcompresso-plana, marginato-alata, intus subcarinata, carina apice in dentem parvum reflexum producta, alis in pappum 2-dentatum extensis; disci abortivi. — Herba erecta, scabro-hispida, forte biennis; caule dichotomo; pedunculis subcymoso-paniculatis gracilibus monocephalis; foliis imis alternis, cæteris oppositis sessilibus oblongo-ovatis basi dentatis, summis pedunculisque glandulis patelliformibus conspersis. Flores aurei.

"L. Texana. — In rupestribus sylvis circa New Braunfels, Texas, *Lindheimer*. — Genus eximium, Berlandieræ et Engelmanniæ cognatum, diximus in honorem ejus acerrimi inventoris qui floram Texanam largiter indagavit.

"Keerlia bellidifolia (*Gray & Engelm.*, *l. c.*): annua, parce ramosa, diffusa, pilis patentibus hirsuto-pubescens; foliis oblongo-spathulatis obtusis mucronatis basi angustatis, summis fere linearibus, radicalibus obovatis petiolatis; squamis involucri ovali-lanceolatis membranaceis glabris mucronato-acuminatis marginibus latissime scariosis 2-seriatis subæqualibus; ligulis (cyaneis) 9 – 12 oblongis; achæniis clavato-fusiformibus vix obcompressis striatis puberis calvis! (pappo

plane nullo). — In sylvis juxta New Braunfels, Texas, *Lindheimer.* — Spithamæa, gracilis, habitu fere Bellidis integrifoliæ sed minor *receptaculo plano*, necnon Brachycomes Xanthocomoidis ? *Torr. & Gr.*, sed diversa *achæniis revera calvis, receptaculo plano*, etc. (Keerlia skirrobasis, *DC.*, est planta depauperata Leucopsidii Arkansani, *DC.*)

"TETRAGONOTHECA TEXANA (*Gray & Engelm.*, *l. c.*): caulibus e radice perenni crasso plurimis gracilibus puberulis; foliis glabris oblongis sinuato-dentatis pinnatifidisve basi connatis imis marginato-subpetiolatis; tubo corollæ glanduloso nec piloso; ovario glabro; achæniis 4 – 5-angulatis striatis. — In collibus juxta flumina Guadaloupe et Cibolo, Texas, *Lindheimer.* — Pedalis, capitulis dimidio minoribus quam in T. helianthoide.

"BARRATTIA, *Gray & Engelm.*, *Pl. Lindh. ined.*

(Senecionideæ-Heliantheæ-Euheliantheæ.)

"Capitulum multiflorum heterogamum; fl. radii ligulatis (circ. 10) neutris, disci tubulosis hermaphroditis. Involucrum imbricatum triseriale, squamis lanceolatis apice herbaceis disco brevioribus. Receptaculum convexum, paleis navicularibus persistentibus achænia amplectentibus. Corolla fere Helianthi. Styli rami elongato-subulati, hispidi. Achænia compresso-plana, emarginato-obcordata, glabra, immarginata, calva. — Herba valida perenni, strigosa, corymboso-ramosa; foliis omnibus oppositis deltoideo-ovatis vel subhastatis inciso-dentatis triplinerviis petiolatis, petiolis basi appendicibus foliaceis interpositis connatis; pedunculis solitaris elongatis monocephalis. Flores radii et disci flavi.

"B. CALVA. — In rupestribus prope originem flum. Guadaloupe, Texas, *Lindheimer.* — Genus a Leighia diversa pappo plane nullo, ab Encelia achæniis non comosis, a Wulfia achæniis compresso-planis, etc., diximus in honorem Josephi Barratti, M. D., botanici inclyti, Salicum præcipue indagatoris.

"It may be proper to append here the characters of another unpublished Helianthoid genus, which is even more closely allied to Encelia (although well distinguished by its pappus), and is also analogous to Agarista.

"GERÆA, *Torr. & Gray*, *Fl. N. Amer. ined.*

"Capitulum multiflorum heterogamum; fl. radii (circ. 15) ligulatis, neutris, disci tubulosis hermaphroditis. Involucrum laxe imbricatum

2–3 seriale, squamis lineari-lanceolatis herbaceis. Receptaculum planum, paleis hyalinis oblongis achænia semi-amplectentibus deciduis onustum. Ligulæ cuneiformes, basi pilosæ: corolla disci fauce dilatato-cylindrica e tubo brevi villoso, 5-dentata. Styli rami in appendicem lineari-filiformem hispidam longe producti. Achænia oblongo-cuneiformia, plano-compressa, marginata, pilis argenteis prælongis (ad margines præsertim) villosissima. Pappus bisquamellatus, squamellis ex marginibus achænii ortis lineari-aristiformibus basi villosissimis corallam adæquantibus. — Herba annua ? hirsuto-cana; caulibus basi foliatis (foliis obovatis rhombeisve alternis) superne nudis subpaniculatis pedunculos paucos 1–2-cephalos gerentibus. Involucrum cano-villosum. Flores radii discique flavi.

"G. canescens. — California, *Fremont*, *Coulter*. Nomen e γεραιός ob capitulum canum necnon comam achænii argenteam sumptum, ut contrarium generi analogo Agaristæ, *DC.* (quæ mythologice nympha erat venustissima).

"AGASSIZIA, *Gray & Engelm.*, *Pl. Lindh. ined.* (non *Chavan.*, nec *Spach.*)

"Capitulum globosum, multiflorum, radiatum; ligulis fœminiis nunc difformibus. Involucrum disco brevius circa biseriale; squamis exterioribus lineari-oblongis, appendicula spathulata vel obtusa foliacea patente, intimis lineari-acuminatis. Receptaculum globosum alveolatum, alveolis valde dentatis fimbrilliferis. Ligulæ cuneatæ, palmato-3–4-fidæ, sæpe irregulares, tubuloso-difformes, vestigia staminum gerentes. Corolla disci Gaillardiæ, dentibus triangulari-lanceolatis. Styli rami ligularum lineares, subulato-apiculati; fl. disci ad basin appendicis brevissimæ nudæ clavato-obtusæ penicellati! Achænia turbinata, sericeo-villosissima. Pappus radii et disci conformis, e paleis 9 hyalinis ovatis uninerviis constans, nervo in aristam capillarem corollam adæquantem longe producto. — Herba biennis, acaulis; radice fusiformi; foliis varie 1–2-pinnatifidis, nunc sinuatis lyratisve; scapo 1–2-pedali, toto nudo, monocephalo. Capitulum Gaillardiæ, speciosum. Flores suaveolentes, disci flavi et purpurei, radii rubescentes.

"A. suavis. — In campis Texanis prope Bexar et New Braunfels, *Lindheimer*. — Genus eximium Gaillardiæ proximum, at ligulis fœminiis, receptaculo globoso vere alveolato, habitu styloque proprio diversum, diximus in honorem celeberrimi amicissimique Agassiz. —

Agassizia, *Chavan.*, est Galvesia, *Domb.* Agassizia, *Spach.*, est Sphærostigma, *Ser.*, et Holostigma, *Spach.*, subgenus merum Œnotheræ."

Two hundred and ninetieth Meeting.

January 27, 1847. — Quarterly Meeting.

The President in the chair.

Mr. Bond communicated the following

Observations on the Planet Neptune, 1846 – 47.

Cambridge Observatory. Long. $4^{h.}\ 44^{m.}\ 32^{s.}$

Greenwich Mean Solar Time.				Apparent A. R. of Neptune			Apparent Dec. of Neptune.			No. of Comp.
	d.	h.	m.	h.	m.	s.	°	′	″	
1846, Oct.	21	14	15	21	51	36.17				2
	24	12	33			30.49	—13	33	25.3	10
	29	11	33			23.85		34	00.4	9
Nov.	3	11	45			20.52		34	14.6	6
	5	10	45			19.53		34	18.9	6
	6	11	55			19.65		34	18.6	9
	18	12	25			28.46		33	25.5	6
	21	12	15			34.54		32	53.5	6
	24	11	59			40.68		32	18.0	7
Dec.	3	12	21		52	07.45		29	54.1	6
	9	11	53			30.70		27	48.3	6
	14	11	45			53.79		25	52.8	8
	21	11	54		53	30.08		22	26.8	3
1847, Jan.	5	11	41		55	05.51		14	02.0	4
	12	11	38			57.45		09	23.6	3
	19	11	30		56	51.30		05	40.7	3
	25	11	06		57	40.31		00	24.2	3

"From Oct. 21st to Jan. 12th the star of comparison was 7648 B. A. C.; its mean place for Jan. 1st, 1846, is A. R. $21^{h.}\ 50^{m.}\ 05^{s.}.94$, Dec. —13° 23′ 55″.5, being a mean of six recent determinations by Professor Challis of Cambridge, England. On Jan. 19th and 25th the planet was compared with a star of the ninth magnitude, the mean place of which, for Jan. 1st, 1846, taken from Bessel's Zone observations, is A. R. $22^{h.}\ 02^{m.}\ 01^{s.}.25$. Dec. —13° 05′ 22″.5.

"The following Circular Elements have been computed by Mr. G. P. Bond, assistant at this Observatory.

"Long. of Asc. Node, 129° 18′.
Inclination, 1° 42′ 26″.
Radius Vector, 30.000.
Daily motion, 21″.709.
Long. at the Opposition, 326° 44′ 31″. Mean Eq., Jan. 1st, 1846.
Gr. M. S. T. of Opposition, Aug. 19th, 706 – 1847.

"Supposing the orbit nearly circular, the time of revolution would be about 164 years."

Dr. Hale read a memorandum on the meteorology of the past season, and especially of the present month, as compared with former years.

John Bacon, Jr., M. D., was elected a Fellow of the Academy.

Two hundred and ninety-first Meeting.

February 2, 1847. — MONTHLY MEETING.

The PRESIDENT in the chair.

Mr. S. P. Andrews exhibited several large charts or diagrams of Chinese syllabic words, and others of Chinese written characters, which he explained. He regretted the absence of several Fellows of the Academy who had expressed an interest in his investigations, and especially of Professor Agassiz, who at a previous meeting wished to know in what the views put forth by Mr. A. differed from those of the distinguished French sinalogue, M. Callery, author of *Systema Phoneticum Scripturæ Sinicæ*. Mr. Andrews said, that he ventured to dissent entirely from the main feature of M. Callery's system in the theoretical point of view.

"The Chinese language consists of no more than 450 words, all of which are regarded as monosyllables, though a few of them are not strictly so. These we may designate, for convenience of reference, *syllabic words*. By the use of different tones in the utterance of these words, a greater circle of effective and distinct words is gained, amounting by the estimate of Abel Rémusat to 1203; the syllable, as to its vocal and consonantal elements, remaining the same.

Words thus distinguished from the same syllables uttered by a different inflexion of the voice we may designate as *tone-words*. But the varying ideas which the Chinese people have occasion to communicate are as numerous as those of other people in the same stage of advancement. Their spoken language is subjected to considerable ambiguities by its meagreness. This deficiency is, however, remedied in a very great degree in the written system; for while the number of spoken words is so very small, there are not less than 30,000 written characters or words, which express shades of thought with about the same minuteness of distinction as the vocabularies of Western languages. Each of these written words, which we may call *sign-words*, has then from one to perhaps twenty distinguishable meanings, like the words of the Latin or English.

"It is obvious from this statement, that for each *syllabic word* of the Chinese language, there is an average of sixty or seventy written or *sign-words*. Otherwise stated, the reader of Chinese meets with this large number of written words having different significations, which he pronounces precisely alike, in the same manner as we pronounce *wright*, *right*, *rite*, and *write* alike, though written differently and signifying differently. Hence these sign-words are called *homophonous*. To some extent, there is a similarity in form between the *sign-words* which thus correspond to a single *syllabic word*, while beyond a certain limit they are entirely diverse. The *sign-words* of the Chinese language consist of single lines, or of complex assemblages of lines or strokes, numbering from the single one up to fifty-two. The attempt to discover the original principles of representation, according to which these complex characters were composed, has been the source of much perplexity to the learned, and the Chinese scholars themselves seem to have little more than a few unsatisfactory fancies upon the subject.

"The conclusion upon which the investigation seems now to rest is, that such changes have taken place in the mode of tracing the lines, and such modifications of the general shape of the characters, that it has become impossible to do more than catch a few very unsatisfactory intimations of the existence of any original design. This conclusion is deemed erroneous, and other views will be offered by Mr. A. upon the subject. One important fact, however, in relation to their composition was early observed by the Chinese themselves, and advantage taken of it to aid them in arranging their *sign-words*

in dictionaries; namely, that there is a small number of characters, reckoned at 214, of very frequent occurrence, and that either alone, or as a component part of a larger character, some one of these frequent signs occurs in every *sign-word* of the language. Hence they have arranged their *sign-words* under these frequent signs as heads of groups, and denominate these last the *keys* of the language.

"Mr. Marshman observed that so much as remains of a compound sign-word, after the key is removed, is likewise a substantive character or sign-word of the language, occurring both by itself and in combination with different keys, so as to furnish another and distinct mode of grouping or classifying the characters. This remaining part of the character after removing the *key* was called by Mr. Marshman the *primitive*. The key is then the *modifier*. (It is also badly denominated the *radical*.) Mr. Marshman supposed that the *primitive* represents the meaning of the whole character in a general way, and that the modifier then renders it definite, much in the same way as the primitive or root word of a Latin or Greek compound verb is modified by the several prepositions prefixed to it, and he adduced a moderate amount of examples to sustain this theory. His observance of related meanings extended only to those few obvious ones which appear at a casual glance, and offered no clew to an integral development of the scheme. No successor of Mr. Marshman has therefore had more success than himself in demonstrating his theory, and M. Callery comes forward to throw discredit upon it altogether, by asserting one quite different from it, and, as he evidently thinks, incompatible with it.

"It has just been shown that the compound sign-words consist each of two parts, one of which is called the *primitive*, and the other the *modifier*. The *modifiers* are not so numerous as the *syllabic words* of the spoken language, while the *primitives* are much more so, being by M. Callery's computation 1040. It has been observed by the Chinese themselves, that, as the general rule, all the *sign-words* which have the same *primitive* are *homophonous*, or, in other words, signify the same *syllabic word*, while those having the same *modifier* have no such established relationship of sound, but generally differ from each other throughout. This fact M. Callery has brought out into a much clearer light, and has made it the basis of his arrangement of the *sign-words* of the language. He advances and contends for the theory, that the *primitive* as previously called, which is usually

by far the most prominent part of the whole *sign-word*, performs no other function than that of indicating the pronunciation, and that whatever reference there is to signification is to be sought in the remaining part previously called the *modifier*. Hence he gives to the *primitive* the name of *phonetic*, and to the *modifier* (or *radical*) that of *classifier*, as he considers it a sign of the class of ideas to which the word relates. This is what he denominates the phonetic system. He rejects entirely the theory of Mr. Marshman, that the primitive gives the general meaning, and the modifier the particular one, and derides the attempt of Mr. Lay to establish a relationship of idea between all the words having the same vocal utterance, or, in other words, between all the numerous meanings of the same syllabic word.

"It will be observed, that the *sign-words* having in them the same *primitive* (phonetic), are not sufficiently numerous to signify all the various meanings of a single syllabic word. Hence there are other *homophonous sign-words* having different *primitives* (phonetics) in their composition, which denote other meanings *of the same vocal utterance*. Hence, again, there are several *phonetics* (considering them as such), generally as many as five or six, employed to signify the *same vocal utterance* or *syllabic word*, and having no other function. This M. Callery supposes to be so, and he accounts for whatever of seeming relation there may be in the meaning of *sign-words* having the same *phonetic* (primitive), on the ground that the *inventor* of this system of writing, having before him several *phonetics*, for the same sound would naturally select a given one of them for those meanings which should happen to be most alike, and so of the others. These several views may be shortly stated thus: —

"Mr. Marshman held that all the *sign-words* which have the same *primitive* (phonetic) must represent ideas which have something in common, and that the *primitive* is the representative of that common element of thought, like the root *pel*, in the words ex*pel*, com*pel*, re*pel*, &c. Of this he adduced some illustrations and presumptive evidence, which are disposed of by M. Callery as just stated.

"Mr. Lay went farther, and held that this common element of thought must be not only coextensive with a single *primitive* (phonetic) among the written *sign-words*, but with the spoken *syllabic word* itself, for which, as before stated, there are several *primitives*. This theory, the boldest which has been put forth, and which is not, as M. Callery seems to suppose, identical with that of Mr. Marshman, is not

very clearly stated by Mr. Lay, and is supported by a few illustrations so utterly fanciful as fully to justify M. Callery in deriding them.

"M. Callery denies the existence of this common element of thought among ideas signified either by the same *syllabic word* or by *sign-words* having a common *primitive* (phonetic). He holds that that part of a compound character called the *primitive*, having been originally invented to represent a *syllabic word* in *a given sense*, was then transferred to and combined with other *sign-words*, representing the same *syllabic word* in senses totally different, and for the sole purpose of indicating that the pronunciation is still the same."

Mr. A. further observed, that several of the terms which he now employed, such as *syllabic word*, *sign-word*, and *tone-word*, were his own; that he employed them in order to render more palpable the differences between these learned writers, as he was able to gather them from their works, than he could do by quoting their own language. It was with extreme diffidence that he ventured to dissent from so ripe and distinguished a scholar as M. Callery. His own studies had led him, however, before he was aware that any such view had been advanced, to the conviction that the theory which he had just now stated, as that of Mr. Lay (and which it must be admitted is but obscurely defined and poorly sustained by Mr. Lay himself), is true. He believes, also, that the observations made by M. Callery (though not his theory), are true likewise, and that the former furnishes the reason of the latter.

In other words, Mr. A. believes, as previously stated to the Academy, that "all the numerous meanings of the same vocal syllable or word in the Chinese language, being in some instances as many as several hundreds, and seeming at first view to have no connection with each other, are in fact legitimately and closely related in *idea*, or that all of these numerous significations constitute a family of ideas, which family is denoted *generically* by the single Chinese syllabic word, and *specifically* in other languages by a *family of words*, which then have corresponding etymological relationships, and *specifically* likewise in the Chinese *written* system, first, by groups of homophonous *sign-words*, having a different *primitive* to each group, and then by the particular *sign-words* within each group having different *modifiers*. Or, differently stated, that a given group of Chinese sign-words have the same *primitive*, not merely because they *sound alike*, but that they both *have the same primitive* and *do sound alike*

for the reason lying still farther back, that they *mean alike;* and further, that this likeness of meaning is not confined to a group of sign-words having the same primitive, but that it can be traced throughout the whole family of *homophonous* sign-words."

"The Chinese written system is not to be considered as an *invention*, as M. Callery seems to do, but as a *growth*, perhaps of several ages, quite similar to the gradual formation of spoken languages in other countries. The law of its growth is to be sought in the spoken language of China which previously existed. It is the greatest of mistakes to suppose the written system to be something quite distinct from and disconnected with the spoken. In order to make out an obvious relation between the numerous and apparently diverse meanings of a Chinese syllabic word, recourse must be had to processes of investigation somewhat new in their kind. The natural relations of ideas to each other must be sought out. Etymology has been too much studied, as the Chinese study anatomy, by mapping out the surface of the body. What we want is that science which shall enable us to trace out a positive relationship between ideas superficially the most remote from each other, as the nerves, and arteries, and veins of the body connect and cause to sympathize parts apparently the least related. These relationships of ideas must be shown to exist metaphysically, and at the same time it must be shown that they are testified to by parallel processes of derivation in various languages, except only the Chinese and a few others, which do not admit of derivation."

Two hundred and ninety-second Meeting.

March 2, 1847. — MONTHLY MEETING.

The PRESIDENT in the chair.

Mr. Andrews presented a dissertation on the Tones of the Siamese Language, by Mr. J. Caswell, American Missionary in Siam, which was referred to the Committee on Publication.

Dr. C. T. Jackson read a paper on the recent discovery, claimed by himself, of the effects of the inhalation of sulphuric ether in producing insensibility to pain.

Two hundred and ninety-third Meeting.

March 16, 1847. — Special Meeting.

The President in the chair.

Professor Peirce communicated to the Academy the following notice of the computations of Mr. Sears C. Walker, who found that a star was missing in the *Histoire Céleste Française*, observed by Lalande on the 10th of May, 1795, near the path of the planet Neptune, at that date, which may possibly have been this planet.

"Shortly after the arrival of the news of the *physical* discovery of Neptune at Berlin, on a suggestion by Mr. E. C. Herrick of its probable identity with the Wartman planet of 1831, Mr. Walker engaged in the study of the orbit of the former, and soon concluded that they could not have been the same, and that no set of elements could be found, with a mean distance at all probable, which would represent the four places of Wartman's planet, as published in the *Comptes Rendus* for 1836.

"His first examination of the orbit of Neptune led to the presumption that the orbit is nearly circular. Also, the large planets lead by analogy to the same conclusion. The eccentricity of

Jupiter	is	0.048
Saturn	"	0.056
Uranus	"	0.047
Neptune	"	$<$ 0.060, *conjectured.*

"With a small eccentricity, it was impossible for the sun's mass at that distance to impress much daily variation of the radius vector. Accordingly, an approximate solution was made from the places observed on the 26th of September, 26th of October, and 21st of November, on the supposition of a constant radius vector. The concluded true sidereal orbital motions n', n, and n'', together with the mean daily sidereal motion μ, for the radius vector $r =$ the semi-axis major $= a$, are here given.

r	n' First thirty days.	n Average motion.	n'' Last 28 days.	μ
34	12''.8	16''.7	19''.7	17''.90
33	14.6	17.7	20.3	18.71
32	16.6	18.8	20.8	19.60
31	19.4	20.1	21.2	20.56
30	21.7	21.6	21.6	21.58
29	24.1	23.4	22.0	22.67

"The most plausible value of r from this table is that in which $(n - n')^2 + (n - n'')^2$ is a minimum. This value by the table is 30 nearly, and for this value we have very nearly $n = n' = n'' = \mu$. Hence the orbit comes out nearly a circle, unless we suppose the planet now to present the possible, but still improbable, case of a great eccentricity and true anomaly nearly 90°.

"Accordingly, he selected for the next trial the circular hypothesis, for which two places of the planet sufficed, those of the 26th of September, from the mean of nine European observations, and the 26th of December, from the mean of 33 transits and 11 measures in declination of Neptune (compared with the same two stars used in September) by himself with the Washington equatorial. All the small corrections were taken into account. In this manner he obtained Elements I. in the table below. These elements enabled him to compute an ephemeris of Neptune for the six months following August 1st, 1846, with which he compared one hundred and sixteen nights' works, seventy of the European and forty-six of the Washington Observatory, and derived from them sixteen normal places, which indicated the following corrections of the geocentric longitude computed from Elements I.

Normal Places of Neptune.

No. of place.	t Date, 1846 yrs. Mean Time, Greenwich.	α Obs. Geo. lon.	hh No. of obs.	δ Obs. Geo. lat.	$h'h'$ No. of obs.	$\Delta\alpha$ Obs. — Eph.	$\Delta\delta$ Obs.—Eph.
	d.	° ′ ″		° ′ ″		″	″
1	215.5670	327 9 49.34	1	— 0 31 36.24	1	— 16.75	— 0.63
2	223.5441	326 57 9.04	1	44.09	1	— 7.27	— 1.03
3	270.5	325 46 25.82	16	57.99	16	— 1.02	+ 0.84
4	276.5	39 54.23	13	56.14	13	+ 0.27	+ 1.51
5	282.5	34 16.11	13	56.09	13	+ 1.12	+ 0.03
6	290.5	28 21.99	12	53.16	12	+ 3.13	+ 0.80
7	298.5	24 25.25	18	51.13	19	+ 4.19	+ 0.56
8	306.5	22 32.46	6	47.61	6	+ 3.02	+ 0.23
9	313.5	22 40.00	4	45.15	3	+ 2.40	— 0.68
10	319.5	24 6.40	4	41.51	6	+ 1.95	+ 0.51
11	325.5	26 50.59?	4	37.30?	4	+ 3.77?	+ 2.21?
12	334.5	33 9.44	7	33.92	6	+ 2.46	— 1.13
13	345.5	44 26.93	4	30.79	4	+ 0.96	— 0.03
14	353.5	54 58.01	2	27.10	2	— 0.72	+ 1.51
15	359.5	326 4 2.52	3	26.04	3	— 0.23	+ 0.77
16	372.5	326 26 39.11	3	23.60	3	— 4.40	+ 1.28

"The above places are referred to the mean equinox of January 1st, 1847, and mean obliquity. The planet's place is corrected for stellar, but not for planetary aberration. It is also corrected for planetary parallax. The residual errors, though small, show in the course of six months a sensible deviation of the orbit from a circular form. They show at the same time that if the eccentricity is greater than 0.06, the true anomaly must be nearly $\pm 90^\circ$, a possible, but, as was said before, an improbable case.

"The next step in the investigation was to make equations of condition of the form, $0 = a\,x + b\,y + c\,z + n$, in which x is $50 \times \Delta\,r$, $y = 10 \times \Delta\,\nu$, $z = \Delta\,\lambda_{300}$, a, b, and c are computed coefficients, ν the daily increase of λ, and λ_{300} the heliocentric longitude of Neptune on the 300th day of the year. Finally, n is the equivalent heliocentric value of $\Delta\,\alpha$ above with sign changed. The number of equations was reduced to nine, by taking for the first the one third of Nos. one and two, above. Then follow the next five unchanged, then the mean of Nos. eight, nine, and ten. No. eleven is rejected, then the mean of Nos. twelve and thirteen. Lastly, the mean of Nos. fourteen, fifteen, and sixteen. The nine conditional equations have then equal weight, and stand thus: —

					Residual Error.
$0 =$	$-\,0.303 \times x$	$-\,2.700 \times y$	$+\,\frac{1}{3} \times z$	$+\,3''.88$,	$-\,0''.08$
$=$	$+\,3.016$	$-\,3.000$	$+\,1$	$+\,1.00$,	$+\,0.49$
$=$	$+\,3.363$	$-\,2.400$	$+\,1$	$-\,0.27$,	$+\,0.19$
$=$	$+\,3.685$	$-\,1.800$	$+\,1$	$-\,1.10$,	$+\,0.22$
$=$	$+\,4.038$	$-\,1.000$	$+\,1$	$-\,3.07$,	$-\,1.03$
$=$	$+\,4.268$	$-\,0.200$	$+\,1$	$-\,4.12$,	$-\,1.31$
$=$	$+\,4.594$	$+\,1.267$	$+\,1$	$-\,2.44$,	$+\,1.03$
$=$	$+\,4.248$	$+\,3.950$	$+\,1$	$-\,1.73$,	$-\,0.13$
$=$	$+\,3.332$	$+\,6.133$	$+\,1$	$+\,1.81$,	$-\,0.16$

The solution by least squares gives,

$$0 = 118.879 \times x + 7.477 \times y + 30.443 \times z - 45''.629.$$
$$0 = 7.477 \times x + 85.149 \times y + 0.250 \times z + 1.687.$$
$$0 = 30.443 \times x + 0.250 \times y + 8.111 \times z - 8.627.$$

Whence,
$$\Sigma\,\epsilon\epsilon = 4''.21.$$
$$x = +\,3.255712.$$
$$y = -\,0.272963.$$
$$z = -\,11.1475.$$

$$r = 29.939950 + \frac{x}{50} = 30.00506.$$

$$n = \frac{v_{359} - v_{270}}{t_{359} - t_{270}}\text{, corrected for aber.} = 21''.65789.$$

$$a = \frac{1}{\frac{2}{r} - \left(\frac{rn}{k^2}\right)^2} = 30.20058.$$

$k =$ Gauss's constant of the earth's velocity.

$$\mu = ka^{-\frac{3}{2}} = 21''.37881.$$

Period $= T =$ 165.97030 tropical years.

"Thus it appeared that Elements II., assuming the eccentricity and perihelion point unknown, and neglecting the daily variation of the radius vector, would give an ephemeris following the planet's path for five months so closely, that the sum of the squares of 9 comparisons of theory with observation was only 4''.21. This residual quantity might have been still further reduced by inserting a fourth term of the form $d\,u$, in which u is the daily increase of r_{300}, and d, a coefficient of the form

$$d = a \,\Delta\, r + \left(\frac{d\lambda}{dt}\right) \Delta\, t,$$

where a is the former coefficient of x, and $\left(\frac{d\lambda}{dt}\right)$ is the daily variation of λ for conservation of areas. Since these terms become sensible in the course of a few additional months, it was thought preferable to postpone the research after the final values of e and π, and by assigning them suitable limits, that of $e < 0.06$, and to π its corresponding value from the equation, $\cos. v = \frac{a(1-e^2)-r}{er}$, then to compute the locus of Neptune's orbit for these limits for any given date, and search for an observation of a missing star in Neptune's path on the same night in some of the ancient catalogues. The fact that $(n - \mu)$ is at this time only 0''.28, shows the limit of $v < \pm 90°$. The following table of limits of v was computed.

	Assumed values of e.	Concluded values of v.
	1.00	± 90°.0
	0.06	± 87.2
	0.05	± 85.4
	0.04	± 83.0
	0.03	± 79.2
	0.02	± 72.2
	0.01	± 50.1
Minimum limit,	0.006474	0.0

"Now, since all values of $\pi = (w - v)$, w being the longitude on the orbit, are *à priori* equally probable, and since the maximum value of v is $\pm 90°$, for $e = 1$, we have the *à priori* probabilities for e as follows: —

Limit of e.	*À priori* probability.
Limit $e > 0.06$ and < 1.00	$\frac{2.7}{90}$
$e > 0.05$ " < 0.06	$\frac{1.8}{90}$
$e > 0.04$ " < 0.05	$\frac{2.4}{90}$
$e > 0.03$ " < 0.04	$\frac{3.8}{90}$
$e > 0.02$ " < 0.03	$\frac{7.0}{90}$
$e > 0.01$ " < 0.02	$\frac{22.1}{90}$
$e > 0.006474 < 0.01$	$\frac{50.1}{90}$

"This *à priori* probability, that e falls between 0.01 and 0.006474, of $\frac{5}{9}$, is derived from a theory, which in a half-year's path of Neptune presents throughout a probable discrepancy of 0''.49 between theory and observation.

"The next inquiry is, how far this value of e is consistent with the equations of condition between e and a, derived from the residual perturbations of Uranus. From the two full computations of Mr. Adams's *Supplement to the Nautical Almanac* for 1852, for values of $\frac{a}{a'} =$ 0.50 and 0.51, e varies from 0.16103 to 0.12062. Hence Mr. Walker found the conditional equation,

$$e = 0.16103 \left[\frac{0.12062}{0.16103}\right] \left(\frac{\log. \frac{a}{38.4}}{\log. \frac{1}{1.03}}\right).$$

Whence for $a = 30.20058$, $e = 0.0153883$, which is the eccentricity from Adams's computations, with this value of the mean distance. The mean longitude of Neptune, according to Mr. Adams's remark, also comes out right for this hypothesis.

"It remains to consider Le Verrier's limits in his additions to the *Connaissance des Temps* for 1849. In his first solution, he gives for the minimum limit of the mean longitude of Neptune for 1800, 234°, whereas Elements II., with $e < 0.0153883$, would require at that date a mean longitude of 226°. In his final solution, Le Verrier finds the most probable value 240° nearly. The limit $\pm 5°$ gives for the minimum 235°. If it be asked why Le Verrier and Adams differ in their conclusions, it may be answered, that they differ in their residual perturbations required, from the more complete computations of

Le Verrier. It was during a discussion of this subject by Professor Peirce and Mr. Walker, that the possible omission of some inequality of long period by Le Verrier was suggested by Professor Peirce. On comparing the mean motions of Uranus and Neptune by Elements II., it was found that if the mean distance of Neptune is thirty nearly, such an inequality of great power has been omitted. Thus we have

$$\begin{array}{rlr} \text{For Uranus,} & \mu' = 42''.2331 & \mu' = 42''.2331. \\ \text{Elements II., Neptune,} & \mu = 21.3788 & 2\,\mu = 42.7576. \\ & & 2\,\mu - \mu' = 0.5245. \end{array}$$

Instead of this, Le Verrier retained only the inequality from $(3\,\mu - \mu')$, which was suited to the mean distance 38.

"It is impossible to decide, without a revision of the calculations of Le Verrier, substituting the new inequality depending on $2\,\mu - \mu'$, whether the limits would not be so far modified as to include Mr. Walker's Elements II. The inequality of $(2\,\mu - \mu)$, if the mean distance is nearly 30, is the most remarkable yet discovered in the primary solar system, and merits a thorough analytical investigation.

"In conclusion, then, it may be remarked, that the hypothesis of a very small eccentricity is strongly probable by the Elements II., probable by Adams's computations from the residual perturbations of Uranus, and not necessarily contradicted by Le Verrier's computed limits, unless we admit also that they exclude at the same time the possibility of the semi-axis major which results so directly from Mr. Walker's normal places.

"It remains to consider the question, whether any light can be thrown on the subject of the orbit of Neptune by the ancient catalogues. On this head it may be remarked that Bradley, Lacaille, and Mayer seldom observed stars of the magnitude 7, 8. In the first three volumes of Piazzi's original observations, now in course of publication by the Vienna Observatory, there is no one of those "not found in the catalogues," that was near enough to the path of Neptune, on the night of observation, to authorize the supposition of its having been that planet. Bessel, in preparing his zones, never swept so far south as the actual position of Neptune. The Paramatha Catalogue seldom extends north of the 33d parallel of south declination. The Madras observations were generally confined to the stars of Piazzi's or Baily's Catalogues. The only remaining chance at present for finding an ancient observation of Neptune (though doubtless others will be found

hereafter) was in the *Histoire Céleste Française*. Mr. Walker found that Lalande had twice included the Neptunian region in his sweeps, viz. May 8th and 10th, 1795. Accordingly, he computed the locus of Neptune on the latter night for all values of e, from 0.006474 to 0.06, and for the two cases of $\pm v$ at the present time. This locus, referred to the mean longitude and obliquity for 1800, so as to compare with Hussey's Hour XIV. in the Catalogue of the Berlin Academy, is as follows: —

LOCUS OF NEPTUNE, MAY 10TH, 1795, FOR VARIOUS ECCENTRICITIES.

		Neptune's R. A. 1800. h. m. s.	Dec. 1800. ° ′
For $+v$, and for	$e = 0.06$	13 45 50	— 9 3.1
"	$e = 0.05$	13 49 48	— 9 24.6
"	$e = 0.04$	13 53 51	— 9 47.0
"	$e = 0.03$	13 57 52	—10 8.6
"	$e = 0.02$	14 1 56	—10 29.6
"	$e = 0.01$	14 3 52.2	—10 40.40
For $v = 0$	$e = 0.006474$	14 9 18.0	—11 8.75
For $-v$	$e = 0.01$	14 12 9.1	—11 23.46
"	$e = 0.02$	14 16 36	—11 44.5
"	$e = 0.03$	14 20 35	—12 6.1
"	$e = 0.04$	14 24 29	—12 25.3
"	$e = 0.05$	14 28 19	—12 44.2
"	$e = 0.06$	14 32 8	—13 2.6

"Mr. Walker then selected from the *Histoire Céleste* all the stars within 15′ of the locus of Neptune in the above table.

No.	Mag.	R. A. 1800. h. m. s.	Dec. 1800. ° ′	Authority.
1	9,10	13 50 36	— 9 24.0	L¹
2	7,8	13 52 48	— 9 58.8	L¹
3	7,8	13 52 53	— 9 45.7	L¹ B¹
4	8,9	13 57 13	—10 11.7	L¹ B¹
5	9	13 59 54	—10 26.4	L¹ B¹
6	8	14 10 0	—11 26.5	L¹ B¹
7	8	14 12 0	—11 8.3	L¹ B¹
8	7,8	14 12 0.9	—11 20.96	L¹ missing star.
9	8	14 29 37	—13 10.7	L¹ B¹

"The only stars in this list, not found in Bessel's Zones, are Nos. 1, 2, and 8. Of these No. 1 is too small. No. 2 is too far south (17′) of Neptune's computed path. No. 8 is within 2′ of the computed

path, and if missing now in the heavens may have been the planet. This comparison was made by Mr. Walker on the 2d of February, a cloudy night. He immediately, by letter of that date, notified the Superintendent of the Observatory, Lieutenant Maury, of his expectation that on examination of that region on the next clear night No. 8 would be missing.

"On the 4th of February, Professor Hubbard examined the region and verified the expectation of Mr. Walker. The star was in fact missing. Here, then, was a presumption in favor of their identity. Mr. Walker believed his limits sufficiently extensive to comprise the Neptunian region of May 8th and 10th, 1795. The planet was of the size 7, 8 magnitude, seldom omitted by Lalande. No star except No. 8 fulfilled all the conditions. There is, however, a (:) placed by Lalande after the observation of the star No. 8, which indicates that the declination is doubtful ± 5′. Mr. Walker's attention was first called to this circumstance by Professor Peirce.

The entries in the *Histoire Céleste* are as follows: —

	Mag.	Wire I.	Mid. Wire.	Wire II.	Zen. Dis.	
			h. m. s.	h. m. s.	° ′ ″	
	7,8		14 11 23.5		60 7 19 :	(now missing.)
2 ♎	6		14 12 3.4		59 33 59	
	8			14 11 50.5 :	59 54 40	

If then the two (:) only indicate a doubt of 5′, there is no contradiction of the possible identity of the star 7,8 mag. and the planet. If, however, the two (:) may be so construed as to make the 1st and 3d star the same in declination as they are in right ascension, then no star is missing, and the heavens are now as in Lalande's time. The difference of magnitudes 7,8 and 8 militates against this supposition, that stars 1 and 3 are the same.

"Mr. Walker concludes by remarking, that he has stated all the circumstances known to him favorable or unfavorable to the supposition of identity of the star and planet. The decision of the question must be the work of time. In order to establish the priority in determining these elements, if the identity should be confirmed, he had computed his Elements III. upon this hypothesis of identity. The three sets of elements are here given, referred to the mean equinox of January 1st, 1847, and to mean time Greenwich."

Elements of Neptune.	Circular Hypothesis I.	Elliptic Hypothesis II.	Elements if the missing star was Neptune. Elliptic Hypothesis III.
Longitude of perihelion, π	unknown	unknown	0° 12′ 25″.51
" " ascend. node, ☊	129° 48′ 23″.16	129° 48′ 23″.16	131° 17′ 35″.80
Inclination, i	1° 45′ 19″.88	1° 45′ 19″.88	1° 54′ 53″.83
Long. of epoch, Jan. 1, 1847, ϵ	unknown	unknown	328° 7′ 56″.64
True heliocentric long. on orbit, Sept. 28, 1847 w	326° 59′ 41″.50	326° 59′ 34″.74	326° 59′ 34″.74
Eccentricity, e	0.	unknown	0.0088407
Radius vector, Sept. 28, 1847, r	29.93995	30.00506	30.02596
True sid. orb. mot., " n	21″.65857	21″.65789	21″.64553
Mean distance, a	29.93995	30.200585	30.25042
Mean daily sidereal motion, μ	21″.65857	21″.37881	21″.32600
Period in tropical years, T	163^y.8259	165^y.97030	166^y.38134

Professor Peirce remarked, that the orbits given by Mr. Walker differ so widely from the predictions, that he has been induced to make a careful reëxamination of the observations. He has not only himself verified Mr. Walker's distance of 30, and the consequent angular motion; but Mr. George P. Bond, of the Cambridge Observatory, has also, at his request, verified this distance and motion from the Cambridge observations alone. From these data, without any hypothesis in regard to the character of the orbit, he has arrived at the conclusion, that THE PLANET NEPTUNE IS NOT THE PLANET TO WHICH GEOMETRICAL ANALYSIS HAD DIRECTED THE TELESCOPE; that its orbit is not contained within the limits of space which have been explored by geometers searching for the source of the disturbances of Uranus; and that its discovery by Galle must be regarded as a happy accident.

"Mr. Adams, in his *Explanation of the Observed Irregularities of Uranus*, considered two hypothetical orbits, in one of which the mean distance is 38.4, or just double that of Uranus, and in the other it is 37.6; while M. Le Verrier, in his *Researches into the Motions of the Planet Herschel, called Uranus*, after deriving some rough approximations from the consideration of the mean distance 38.4, proceeds to the accurate examination of the three distances 39.1, 37.6, and 36.2.

The extension of the investigations to any other mean distances can be made only by assuming a continuous law to pervade the subject of inquiry, and that there is no important change in the character of the resulting perturbations. Guided by this principle, well established, and legitimate, if confined within proper limits, M. Le Verrier narrowed with consummate skill the field of research, and arrived at two fundamental propositions, namely, —

1st. That the mean distance of the planet cannot be less than 35, or more than 37.9. The corresponding limits of the time of sidereal revolution are about 207 and 233 years.

2d. "That there is only one region in which the disturbing planet can be placed, in order to account for the motions of Uranus; that the mean longitude of this planet must have been, on January 1st, 1800, between 243° and 252°."

"Neither of these propositions is of itself necessarily opposed to the observations which have been made upon Neptune, but the two combined are decidedly inconsistent with observation. It is impossible to find an orbit, which, satisfying the observed distance and motion, is subject at the same time to both of these propositions, or even approximately subject to them. If, for instance, a mean longitude and time of revolution are adopted according with the first, the corresponding mean longitude in 1800 must have been at least 40° distant from the limits of the second proposition. And again, if the planet is assumed to have had in 1800 a mean longitude near the limits of the second proposition, the corresponding time of revolution with which its motions satisfy the present observations cannot exceed 170 years, and must therefore be about 40 years less than the limits of the first proposition. Neptune cannot, then, be the planet of M. Le Verrier's theory, and cannot account for the observed perturbations of Uranus under the form of the inequalities involved in his analysis.

"It is not, however, a necessary conclusion that Neptune will not account for the perturbations of Uranus, for its probable mean distance of about 30 is so much less than the limits of the previous researches, that no inference from them can be safely extended to it. An important change, indeed, in the character of the perturbations takes place near the distance 35.3; so that the continuous law by which such inferences are justified is abruptly broken at this point, and it was hence an oversight in M. Le Verrier to extend his inner limit to the distance 35. A planet at the distance 35.3 would revolve about the

Sun in 210 years, which is exactly two and a half times the period of the revolution of Uranus. Now, if the times of revolution of two planets were exactly as 2 to 5, the effects of their mutual influence would be peculiar and complicated, and even a near approach to this ratio gives rise to those remarkable irregularities of motion which are exhibited in Jupiter and Saturn, and which greatly perplexed geometers until they were traced to their origin by Laplace. This distance of 35.3, then, is a complete barrier to any logical deduction, and the investigations with regard to the outer space cannot be extended to the interior.

"The observed distance 30, which is probably not very far from the mean distance, belongs to a region which is even more interesting in reference to Uranus than that of 35.3. The time of revolution which corresponds to the mean distance 30.4 is 168 years, being exactly double the year of Uranus, and the influence of a mass revolving in this time would give rise to very singular and marked irregularities in the motions of this planet. The effect of a near approach to this ratio in the mean motions is partially developed by Laplace, in his theory of the motions of the three inner satellites of Jupiter. The whole perturbation arising from this source may be divided into two portions or inequalities, one of which, having the same period with the time of revolution of the inner planet, is masked to a great extent behind the ordinary elliptic motions, while the other has a very long period, and is exhibited for a great length of time under the form of a uniform increase or diminution of the mean motion of the disturbed planet. But it is highly probable that the case of Neptune and Uranus is not merely that of a near approach to the ratio of 2 to 1 in their times of revolution, but that this ratio is exactly preserved by those planets; for it may be shown, as was shown by Laplace for the ratio two fifths, that a sufficiently near approach to it must, on account of the mutual action of the planets, result in the permanent establishment of this remarkable ratio. Thus, if

$v =$ the mean longitude of Uranus,

$v' =$ that of Neptune,

$V = 2v' - v$; and if D expresses the differential coefficient relatively to the time, a near approach to the ratio of 2 to 1 gives the equations,

$$D^2 v = p \sin. (2v' - v + A) = p \sin. (V + A),$$

$$D^2 v' = q \sin. (2v' - v + A) = q \sin. (V + A);$$

in which p, q, and A are known functions of the masses and different elements of the orbits. These equations give at once

$$D^2V = 2\,D^2v' - D^2v = (2\,q - p)\ \text{sin.}\ (V + A),$$

which, multiplied by 2 D V and integrated, becomes

$$DV = \sqrt{[H^2 - (4\,q - 2p)\ \text{cos.}\ (V + A)]},$$

in which $\quad H = 2\,n' - n\,;$
if $\quad n =$ the mean motion of Uranus,
and $\quad n' =$ that of Neptune.

It follows from the value of DV, that if

$$H^2 < 4\,q - 2\,p,$$

V + A cannot increase indefinitely, and that, therefore, the term

$$(2\,n' - n)\ t,$$

upon which its indefinite increase depends, must vanish, or in other words $\quad 2\,n' - n = 0,$

and V + A must oscillate in value either
about zero when $\quad 2\,p - 4\,q$ is positive,
or about 180° when $\quad 2\,p - 4\,q$ is negative.

The probability of the occurrence of this ratio depends, it will be seen, upon the magnitudes of p and q, which are always of opposite signs. It is evident, from inspecting the computations of Mr. Walker, that Neptune's period of revolution is not less than in his second hypothesis of 166 years; and Professor Peirce infers from the investigations which he has already made, that a period of 166½ years, which involves only a slight additional eccentricity, is already a sufficiently near approximation to establish the exact permanency of the period of 168 years. As soon, then, as there may be observations sufficient to prove that Neptune revolves in more than 166½, and in less than 169½ years, the conclusion is inevitable, that its year is precisely twice as long as that of Uranus."

Professor Peirce communicated, from Mr. Bond, of the Cambridge Observatory, the following

Observations on the Comet of March 4th, 1847.

Made at Cambridge Observatory. Long. $4^{h.}\ 44^{m.}\ 32^{s.}$.

Corrected for refraction, and referred to the Mean Equinox of Jan. 1st, 1847.

Cambridge Mean Solar Time.	Comet's A. R.	Comet's Dec.	Star of Comparison. A. R.	Star of Comparison. Dec.	No. of Comp.	
1847. d. h. m. s.	h. m. s.	° ′ ″	h. m. s.	° ′ ″		
Mar. 4 8 40 09	23 35 50.5	+50 01 46	23 35 14.67	49 44 08.3	6	Star of 10th mag. comp. with 18 Andr.
" 5 8 36 54	23 39 13.2	48 54 28	23 33 59.16	48 39 54.9	6	Gr. Cat. 4125.
" 6 8 31 01	23 42 28.5	47 45 43	23 45 09.36	47 37 55.0	4	St. of 9th mag. comp. with Gr. 4167 & 4175.
" 8 7 24 29	23 48 38.6	45 25 14	23 47 54.82	45 30 26.6	6	Gr. Cat. 4166.
			23 51 00.34	45 33 40.5	6	" 4181.
" 10 7 18 20	23 54 31.1	42 53 34	23 55 20.47	42 47 29.4	5	St. of 9th mag. comp. with 30 Gr. [illegible] Andr.
" 11 17 02 06	23 58 27.9	41 00 52	23 [illegible] 52.80	41 10 15.3	3	Gr. 4212.
			23 56 45.49	41 14 29.1	9	Gr. 4219.
" 12 8 22 37	0 00 10.1	40 08 09	0 06 35.14	40 11 28.2	4	23 Andromedæ.
" 15 8 00 57	0 07 40.4	35 44 37	0 10 21.07	35 56 12.0	4	σ Andromedæ.
" 19 7 19 15	0 16 16.6	29 03 34	0 22 03.57	28 54 28.4	4	28 Andromedæ.
" 24 7 13	0 24 26	18 36 07	1 45 08.65	18 32 37.3	1	γ^2 Arietis.

" *March 4th.* The comet was first seen at 7 o'clock, in close proximity to a star of the 10, 11 magnitude; in brightness it appears to be but just beyond the limit of unassisted vision. It has no visible nucleus, and but slight condensation of light towards its centre. Faint traces of a tail are suspected in a direction nearly opposite to the sun. The observations this evening are made with the annular micrometer.

" *March 5th.* From this date up to the 24th, the spider-line micrometer was employed, the field being illuminated with red light.

" *March 6th.* The comet is brighter than heretofore, showing a tail of 20′ in length, of a conical outline, its axis being directed towards the sun. The head of the comet is very irregular, its light is somewhat concentrated, but there is no well-defined nucleus, which circumstance in some degree affects the accuracy of the observations.

" *March 8th.* To-night, for the first time, the comet is visible to the naked eye, as a star of the fifth or sixth magnitude. The angle of position of the tail is n. f. 76° 30′; consequently it is not exactly in a direction opposite to the sun. The estimated diameter of the light surrounding the head was four or five minutes of arc.

" *March 12th.* In the comet-seeker the tail may be traced two or three degrees. Angle of position of its axis is 81° n. f.

" *March 15th.* The rough and irregular outline of this comet reminds one of the figures of Hevelius. Length of the tail four or five degrees.

" *March 24th.* The altitude of the comet at this observation

was three degrees. The place given is derived from a single passage over the annular micrometer, and is therefore liable to some uncertainty; it however agreed nearly with the result from instrumental readings.

"The following elements have been computed from the observations given above. By Professor Peirce, from the observations on March 4th, 5th, and 6th.

1847, Per. passage, March $31^{d}.907$, Greenwich M. S. T.

" distance, 0.04444.

Long. of ascending node, 10° 13′.

" perihelion, 256 33.

Inclination, ♦48 53.

Motion direct.

"By G. P Bond, from places of March 5th, 12th, and 19th, account being taken of the small corrections.

1847, Per. passage, March $30^{th}.3369$, Greenwich M. S. T.

" distance, 0.0445986.

Long. of ascending node, 21° 06′ 46″.

" perihelion, 275 16 22.

Inclination, 48 41 49.

Motion direct.

"The places computed from the latter orbit require the following corrections.

March 5th,	Obs'd — Comp. Long.	= + 0.′2	Obs'd — Comp. Lat.	= +	0.″5.
12th,	" "	= — 3.6	" "	= —	44.5.
19th,	" "	= — 0.3	" "	= —	0.7."

Mr. William C. Bond communicated a second series of moon culminations observed at the Cambridge Observatory.

"The observations now presented to the Academy were made at the first station occupied as an Observatory in Cambridge. Lat. 42° 22′ 22″. Long. $4^{h.}$ $44^{m.}$ $30^{s.}$. The Transit Instrument has an object-glass of 2½ inches aperture, and 46 inches focus. The clock error has been determined solely by means of the standard stars of the *Nautical Almanac*. The southern meridian mark of this station is situated on Blue Hill, in Canton; it is placed on a massive and conspicuous stone tower, erected for the purpose, 58,520 feet south of the transit instrument, and within a short distance of one of the principal stations of the State and United States Surveys.

Moon Culminations,

Observed at Cambridge, corrected for Collimation, Level, and Azimuthal Deviation of the Transit Instrument, and for Clock Rate and Error on Sidereal Time.

Lat. +42° 22′ 22″. Lon. West of Greenwich, 4 h. 44 m. 30 s.

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1840, Jan. 12	☽'s 1st Limb	1 44 54.04			B*
"	α Arietis	1 58 10.64	10.55	— 0.09	"
"	δ Arietis	3 02 30.62	30.36	— 0.26	"
13	β Arietis	1 45 49.50	49.34	— 0.16	W
"	α Arietis	1 58 10.48	10.53	+ 0.05	"
"	☽'s 1st Limb	2 42 28.24			"
"	δ Arietis	3 02 30.28	30.36	+ 0.08	"
"	ς Arietis	3 14 53.04	53.30	+ 0.26	"
16	l Aurigæ	5 28 24.05	23.70	— 0.35	B
"	☽'s 1st Limb	6 01 15.84			"
"	κ Aurigæ	6 05 12.89	13.12	+ 0.23	"
"	μ Geminorum	6 13 18.88	18.85	— 0.03	"
"	ε Geminorum	6 34 07.23	07.34	+ 0.11	"
17	β Tauri	5 16 12.87	12.83	— 0.04	"
"	κ Aurigæ	6 05 13.33	13.12	— 0.21	"
"	μ Geminorum	6 13 18.67	18.85	+ 0.18	"
"	ε Geminorum	6 34 07.42	07.34	— 0.08	"
"	☽'s 1st Limb	7 09 28.92			"
"	α^2 Geminorum	7 24 25.31	25.41	+ 0.10	"
"	β Geminorum	7 35 33.65	33.44	— 0.21	"
18	ω Geminorum	6 52 41.72			W
"	δ Geminorum	7 10 36.04	36.00	— 0.04	"
"	β Geminorum	7 35 33.43	33.41	— 0.02	"
"	☽'s 1st Limb	8 13 42.30			"
"	☽'s 2d Limb	8 16 08.94			"
"	δ Cancri	8 35 37.18	37.22	+ 0.04	"
21	ε Leonis	9 36 47.57	47.74	+ 0.17	B
"	γ Leonis	10 11 10.50	10.41	— 0.09	"
"	ρ Leonis	10 24 25.29	24.75	— 0.54	"
"	☽'s 2d Limb	10 58 15.15			"
"	σ Leonis	11 12 55.05	54.74	— 0.31	"
"	l Leonis	11 22 09.73	09.95	+ 0.22	"
23	b Virginis	11 51 46.40	46.47	+ 0.07	"
"	η Virginis	12 11 44.37	44.50	+ 0.13	"
"	☽'s 2d Limb	12 30 43.64			"
"	γ Virginis	12 33 35.14	34.33	— 0.81	"
"	ψ Virginis	12 46 03.42	03.53	+ 0.11	"

* B is the initial of *William C. Bond;* W, that of *William C. Bond, Jr.*

Date.	Name of Object.	Sidereal Time of Meridian Passage. h. m. s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1840, Jan. 23	α Virginis	13 16 47.23	47.19	—0.04	B
24	γ Virginis	12 33 34.36	34.36	0.00	"
"	ψ Virginis	12 46 03.16	03.56	+0.40	"
"	☽'s 2d Limb	13 16 08.73			"
"	o Virginis	13 37 25.68	25.77	+0.11	"
Feb. 12	α Tauri	4 26 46.18	45.99	—0.19	W
"	ι Aurigæ	4 46 36.67	36.44	—0.23	"
"	β Tauri	5 16 12.56	12.60	+0.03	"
"	☽'s 1st Limb	5 34 51.03			"
"	C Tauri	5 43 18.32	18.18	—0.14	"
13	κ Aurigæ	6 03 13.91	12.98	—0.97	B
"	μ Geminorum	6 12 18.97	18.70	—0.27	"
"	☽'s 1st Limb	6 41 43.50			"
"	τ Geminorum	7 00 59.63	59.27	—0.36	"
"	α² Geminorum	7 24 25.60	25.46	—0.14	"
"	β Geminorum	7 35 33.49	33.50	+0.01	"
15	β Geminorum	7 35 33.31	33.49	+0.18	"
"	6 Cancri	7 53 43.35	42.98	—0.37	"
"	ϑ Cancri	8 22 30.53	30.30	—0.23	"
"	☽'s 1st Limb	8 46 04.42			"
"	q Cancri	9 10 04.89	04.85	—0.04	"
17	ν Leonis	9 49 39.05	39.00	—0.05	W
"	α Leonis	9 59 53.16	53.13	—0.03	"
"	☽'s 2d Limb	10 34 52.74			"
"	l Leonis	10 40 52.69	52.62	—0.07	"
"	χ Leonis	10 56 47.66	47.79	+0.13	"
21	☽'s 2d Limb	13 42 10.32			B
"	κ Virginis	14 04 23.10	23.73	+0.63	"
"	α² Libræ	14 42 03.81	03.64	—0.17	"
"	α Scorpii	16 19 36.16	37.37	+1.27	"
March 8	☽'s 1st Limb	3 05 12.38			"
"	α Tauri	4 26 45.70	45.66	—0.04	"
9	☽'s 1st Limb	4 08 39.16			W
"	β Tauri	5 16 12.34	12.18	—0.16	"
11	β Tauri	5 16 12.14	12.14	0.00	B
"	☽'s 1st Limb	6 21 01.29			"
"	ε Geminorum	6 34 07.19	06.90	—0.29	"
"	τ Geminorum	7 00 59.34	58.93	—0.41	"
12	δ Geminorum	7 11 35.45	35.71	—0.26	"
"	☽'s 1st Limb	7 27 08.75			"
"	β Geminorum	7 35 33.11	33.21	+0.10	"
"	δ Geminorum	8 35 38.02	37.33	—0.69	"
13	δ Geminorum	7 10 35.87	35.69	—0.18	"
"	α² Geminorum	7 24 24.87	25.14	+0.27	"
"	β Geminorum	7 35 33.42	33.20	—0.22	"
"	φ Geminorum	7 43 44.24	44.08	—0.16	"
"	☽'s 1st Limb	8 25 18.33			"

Date.	Name of Object.	Sidereal Time of Meridian Passage. h. m. s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1840, March 13	δ Cancri	8 36 37.46	37.32	— 0.14	B
"	α^2 Cancri	8 49 46.12	45.97	— 0.15	"
14	δ Geminorum	7 10 35.79	35.68	— 0.11	W
"	α^2 Geminorum	7 24 24.90	25.12	+ 0.22	"
"	β Geminorum	7 35 33.43	33.18	— 0.25	"
"	α^2 Cancri	7 49 46.37	45.97	— 0.40	"
"	☽'s 1st Limb	9 20 59.40			"
"	π Leonis	9 59 48.09	47.63	— 0.46	"
"	ε Leonis	9 36 48.43	48.10	— 0.33	"
16	ε Hydræ	8 38 19.90	20.05	+ 0.15	B
"	α Leonis	9 59 53.48	53.18	— 0.30	"
"	ϱ Leonis	10 24 25.20	25.33	+ 0.13	"
"	☽'s 1st Limb	11 01 15.84			"
"	σ Leonis	11 12 55.47	55.56	+ 0.09	"
"	δ Leonis	11 05 38.16	38.07	— 0.09	"
"	υ Leonis	11 28 47.54	47.80	+ 0.26	"
21	λ Virginis	14 09 30.13	30.09	— 0.04	"
"	☽'s 2d Limb	14 59 26.51			"
"	χ Libræ	15 30 52.07	52.11	+ 0.04	"
April 5	☽'s 1st Limb	3 44 55.02			"
"	β Tauri	5 16 11.74	11.71	— 0.03	"
6	α Tauri	4 26 45.22	45.20	— 0.02	"
"	☽'s 1st Limb	4 52 10.58			"
7	☽'s 1st Limb	6 00 11.32			"
"	ε Geminorum	6 33 06.53	06.43	— 0.10	"
9	α^2 Geminorum	7 24 24.35	24.65	+ 0.30	"
"	β Geminorum	7 35 32.74	32.75	+ 0.01	"
"	☽'s 1st Limb	8 07 30.03			"
"	ϑ Cancri	8 22 30.17	29.76	— 0.41	"
"	δ Cancri	8 35 37.27	36.97	— 0.30	"
10	ϑ Cancri	8 22 29.63	29.74	+ 0.11	W
"	δ Cancri	8 35 36.73	36.95	+ 0.22	"
"	☽'s 1st Limb	9 04 20.32			"
"	λ Leonis	9 22 37.31	37.14	— 0.17	"
"	o Leonis	9 32 38.75	38.51	— 0.24	"
13	α Hydræ	9 19 44.99	45.24	+ 0.25	"
"	ε Leonis	9 36 47.79	47.81	+ 0.02	"
"	α Leonis	9 59 53.02	52.96	— 0.06	"
"	χ Leonis	10 56 47.92	47.90	— 0.02	B
"	q Leonis	11 09 05.89	05.74	— 0.15	"
"	☽'s 1st Limb	11 31 49.67			"
"	β Virginis	11 42 24.26	24.31	+ 0.05	"
"	b Virginis	11 51 47.93	47.49	— 0.44	"
15	β Corvi	12 26 02.10	02.04	— 0.06	W
"	53 Virginis	13 03 35.56	35.65	+ 0.09	"
"	☽'s 2d Limb	13 05 11.89			"
16	β Corvi	12 26 02.03	02.05	+ 0.02	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A.R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1840, April 16	α Virginis	13	16	48.91	48.85	— 0.06	W
"	☽'s 2d Limb	13	52	01.67			"
"	λ Virginis	14	10	30.61	30.49	— 0.12	"
17	λ Virginis	14	10	30.46	30.50	+ 0.04	B
"	☽'s 2d Limb	14	40	41.44			"
"	$α^2$ Libræ	14	42	05.24	04.88	— 0.36	"
"	20 Libræ	14	54	46.29	46.20	— 0.09	"
"	β Libræ	15	08	26.77	26.83	— 0.06	"
21	α Scorpii	16	19	39.04	39.17	+ 0.13	W
"	$γ^2$ Sagittarii	17	55	34.20	34.59	+ 0.39	"
"	$μ^1$ Sagittarii	18	04	14.15	14.02	— 0.13	"
"	☽'s 2d Limb	18	15	17.42			"
"	φ Sagittarii	18	35	41.78	41.83	+ 0.05	"
"	σ Sagittarii	18	45	23.10	22.77	— 0.33	"
May 11	τ Leonis	11	19	44.70	44.72	+ 0.02	"
"	☽'s 1st Limb	12	03	04.42			"
"	η Virginis	12	11	45.84	45.56	— 0.32	"
"	q Virginis	12	25	33.94	33.85	— 0.09	"
"	α Virginis	13	16	48.84	48.91	+ 0.07	"
13	β Corvi	12	26	02.09	01.97	— 0.12	"
"	ϑ Virginis	13	01	42.99	42.99	0.00	"
"	α Virginis	13	16	48.92	48.91	— 0.01	"
"	☽'s 1st Limb	13	34	18.37			"
"	κ Virginis	14	04	24.89	24.97	+ 0.08	"
14	β Corvi	12	26	01.86	01.97	+ 0.11	"
"	α Virginis	13	16	48.86	48.91	+ 0.05	"
"	κ Virginis	14	04	25.02	24.97	— 0.05	"
"	☽'s 1st Limb	14	22	00.09			"
"	20 Libræ	14	54	46.27	46.54	+ 0.27	"
"	β Libræ	15	08	27.32	27.15	— 0.17	"
15	☽'s 1st Limb	15	11	57.22			B
"	☽'s 2d Limb	15	14	29.78			"
"	κ Libræ	15	32	47.55	47.44	— 0.11	"
"	σ Scorpii	16	11	31.83	31.66	— 0.17	"
"	α Scorpii	16	19	39.72	39.67	— 0.05	"
16	$β^1$ Scorpii	15	56	11.52	11.63	+ 0.11	"
"	☽'s 2d Limb	16	06	35.15			"
"	α Scorpii	16	19	39.90	39.70	— 0.20	"
"	σ Scorpii	16	11	31.38	31.68	+ 0.30	"
17	π Scorpii	15	49	13.80	14.36	+ 0.56	"
"	β Scorpii	15	56	11.89	11.66	— 0.23	"
"	σ Scorpii	16	11	31.37	31.70	+ 0.33	"
"	α Scorpii	16	19	39.51	39.72	+ 0.21	"
"	τ Scorpii	16	25	59.25	59.29	+ 0.04	"
"	☽'s 2d Limb	17	00	58.98			"
"	A^1 Ophiuchi	17	05	33.92	34.32	+ 0.40	"
"	ϑ Ophiuchi	17	12	14.41	14.50	+ 0.09	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A.R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1840, May 17	e^2 Ophiuchi	17	21	42.37			B
June 5	ε Leonis	9	59	52.40	52.37	— 0.03	W
"	☽'s 1st Limb	10	12	35.42			"
"	δ Leonis	11	05	37.52	37.46	— 0.06	"
8	☽'s 1st Limb	13	19	32.72			"
"	z Virginis	13	41	13.94	13.75	— 0.19	"
10	☽'s 1st Limb	14	06	27.42			"
"	λ Virginis	14	10	30.50	30.70	+ 0.20	"
"	α^2 Libræ	14	42	05.30	05.24	— 0.06	"
11	λ Virginis	14	10	30.84	30.70	— 0.14	"
"	α^2 Libræ	14	42	05.00	05.24	+ 0.24	"
"	☽'s 1st Limb	14	55	33.52			"
"	ι Libræ	15	03	09.62	09.92	— 0.30	"
"	β Libræ	15	08	27.22	27.29	+ 0.07	"
"	β^1 Scorpii	15	56	11.60	11.89	+ 0.29	"
13	β^1 Scorpii	15	56	11.93	11.90	— 0.03	B
"	σ Scorpii	16	11	31.82	32.00	+ 0.18	"
"	α Scorpii	16	19	40.00	40.04	+ 0.04	"
"	τ Scorpii	16	25	59.65	59.72	+ 0.07	"
"	☽'s 1st Limb	16	40	53.00			"
"	A Ophiuchi	17	05	34.80	34.77	— 0.03	"
"	ϑ Ophiuchi	17	11	15.35	14.96	— 0.39	"
14	α Virginis	13	16	48.90	48.78	— 0.12	"
"	α^2 Libræ	14	42	05.40	05.23	— 0.17	"
"	α Scorpii	14	19	40.20	40.04	— 0.16	"
"	☽'s 1st Limb	17	36	11.70			"
"	☽'s 2d Limb	17	39	29.84			"
15	α Scorpii	16	19	40.06	40.45	+ 0.39	W
"	γ^2 Sagittarii	17	55	55.95	36.00	+ 0.05	"
"	μ^1 Sagittarii	18	04	15.38	15.37	— 0.01	"
"	δ Sagittarii	18	10	48.95	49.01	+ 0.06	"
"	☽'s 2d Limb	18	34	05.74			"
"	σ Sagittarii	18	45	24.37	24.35	— 0.02	"
"	τ Sagittarii	18	57	01.01	00.78	— 0.23	"
16	☽'s 2d Limb	19	28	40.96			B
"	c Sagittarii	19	52	52.50	52.46	— 0.04	"
"	α^2 Capricorni	20	09	13.62	13.55	— 0.07	"
"	β^2 Capricorni	20	12	04.15	04.38	+ 0.23	"
July 10	α^2 Libræ	14	42	05.00	05.10	+ 0.10	W
"	β Libræ	15	08	27.13	27.19	+ 0.06	"
"	b Scorpii	15	41	25.46	25.44	— 0.02	"
"	δ Scorpii	15	50	56.41	56.37	— 0.04	"
"	β^1 Scorpii	15	57	12.06	11.90	— 0.16	"
"	δ Ophiuchi	16	05	01.10	01.16	— 0.06	"
"	α Scorpii	16	19	40.12	40.10	— 0.02	"
"	☽'s 1st Limb	16	22	27.29			"
"	τ Scorpii	16	25	59.63	59.72	+ 0.09	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A.R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1840, July 11	α^2 Libræ	14	42	05.12	05.09	—0.03	W
"	β Libræ	15	08	27.37	27.18	—0.19	"
"	β^1 Scorpii	15	56	11.92	11.90	—0.02	"
"	δ Ophiuchi	16	06	01.34	01.18	—0.16	"
"	α Scorpii	16	19	40.07	40.10	+0.03	"
"	τ Scorpii	16	25	59.82	59.72	—0.10	"
"	☽'s 1st Limb	17	17	25.64			"
"	e^2 Ophiuchi	17	21	43.63	43.35	—0.28	"
"	α Ophiuchi	17	26	33.94	33.80	—0.14	"
"	Sagittarii	17	48	53.25	53.06	—0.19	"
12	β Libræ	15	08	27.20	27.18	—0.02	B
"	β^1 Scorpii	15	56	11.78	11.89	+0.11	"
"	δ Ophiuchi	16	06	00.92	01.18	+0.26	"
"	α Scorpii	16	19	40.11	40.09	—0.02	"
"	e^2 Ophiuchi	17	21	43.35	43.35	0.00	"
"	☽'s 1st Limb	18	13	11.79			"
"	Sagittarii	17	48	53.21	53.07	—0.15	"
"	φ Sagittarii	18	35	43.83	43.76	—0.07	"
14	μ^1 Sagittarii	18	04	15.79	15.67	—0.12	W
"	χ^1 Sagittarii	19	15	36.26	36.20	—0.06	"
"	h^2 Sagittarii	19	27	02.16	02.20	+0.04	"
"	☽'s 1st Limb	20	02	19.43			"
"	☽'s 2d Limb	20	04	34.15			"
"	α^2 Capricorni	20	10	15.20	14.11	—0.09	"
"	υ Capricorni	20	31	00.26	00.17	—0.09	"
15	υ Capricorni	20	31	00.16	00.19	+0.03	B
"	☽'s 2d Limb	20	56	12.49			"
"	s Capricorni	21	06	57.02	57.03	+0.01	"
"	ε Capricorni	21	28	10.96	10.72	—0.24	"
16	s Capricorni	21	06	57.06	57.05	—0.01	W
"	β Aquarii	21	23	11.21	11.43	+0.25	"
"	ε Capricorni	21	28	10.54	10.74	+0.20	"
"	ε Pegasi	21	36	22.83	22.97	+0.17	"
"	☽'s 2d Limb	21	45	45.04			"
"	ι Aquarii	21	57	50.95	51.01	+0.06	"
"	ϑ Aquarii	22	08	26.30	26.55	+0.25	"
"	ζ Pegasi	22	33	32.00	32.06	+0.06	"
"	Fomalhaut	22	48	51.22	51.20	—0.02	"
"	α Pegasi	22	56	50.74	50.66	+0.08	"
20	d Piscium	0	12	24.98	25.01	+0.03	B
"	β Ceti	0	35	36.00	36.14	+0.14	"
"	☽'s 2d Limb	0	59	07.90			"
21	☽'s 2d Limb	1	52	17.62			"
"	α Arietis	1	58	12.27	12.20	—0.07	"
August 4	☽'s 1st Limb	14	19	25.92			W
"	δ Ophiuchi	16	06	01.00	00.97	—0.03	"
7	☽'s 1st Limb	16	56	54.77			"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A.R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1840, Aug. 7	A Ophiuchi	17 05 34.48	34.79	+ 0.31	W
"	ϑ Ophiuchi	17 12 15.20	15.01	— 0.19	"
"	α Ophiuchi.	17 27 33.74	33.65	— 0.09	"
8	ϑ Ophiuchi	17 12 15.08	15.00	— 0.08	"
"	☽'s 1st Limb	17 52 31.63			"
"	γ^2 Sagittarii	17 55 35.84	36.24	+ 0.40	"
"	μ^1 Sagittarii	18 04 15.55	15.64	+ 0.09	"
"	λ Sagittarii	18 18 09.75	09.94	+ 0.19	"
9	β^1 Scorpii	15 56 11.64	11.63	— 0.01	B
"	δ Ophiuchi	16 06 00.96	00.93	— 0.03	"
"	α Scorpii	16 19 39.67	39.85	+ 0.18	"
"	μ^1 Sagittarii	18 04 15.79	15.63	— 0.16	"
"	λ Sagittarii	18 18 09.54	09.93	+ 0.39	"
"	χ Sagittarii	19 15 36.86	36.33	— 0.56	"
"	☽'s 1st Limb	18 48 11.55			"
"	ν Sagittarii	18 57 01.28	01.32	+ 0.04	"
10	ν Sagittarii	18 57 01.36	01.32	— 0.04	W
"	☽'s 1st Limb	19 42 48.90			"
"	c Sagittarii	19 52 53.19	53.25	+ 0.06	"
"	α^2 Capricorni	20 09 14.35	14.35	0.00	"
"	β^2 Capricorni	20 12 05.11	05.13	+ 0.02	"
14	λ Aquarii	22 44 19.72	19.76	+ 0.04	"
"	ζ Pegasi	22 33 32.51	32.61	+ 0.10	"
"	Fomalhaut	22 48 52.06	52.00	— 0.06	"
"	α Pegasi	22 56 51.32	51.28	— 0.04	"
"	☽'s 2d Limb	23 06 56.21			"
"	γ Piscium	23 08 55.97	56.03	+ 0.06	"
"	λ Piscium	23 34 56.63	56.87	+ 0.24	"
"	γ Pegasi	0 05 03.78	03.64	— 0.14	"
15	☽'s 2d Limb	23 54 11.67			B
"	d Piscium	0 12 25.88	25.69	— 0.19	"
"	β Ceti	0 35 37.14	36.85	— 0.29	"
16	ι Piscium	23 31 47.02	46.87	— 0.15	"
"	γ Pegasi	0 05 03.69	03.69	0.00	"
"	d Piscium	0 12 25.29	25.71	+ 0.42	"
"	☽'s 2d Limb	0 43 43.79			"
"	ε Piscium	0 54 42.09	42.13	+ 0.04	"
"	ϑ^1 Ceti	1 16 04.50	04.93	+ 0.43	"
17	☽'s 2d Limb	1 35 47.30			W
"	β Arietis	1 45 52.08	51.99	— 0.09	"
"	α Arietis	1 58 13.36	13.09	— 0.27	"
"	α Ceti	2 53 58.06	58.13	+ 0.07	"
18	☽'s 2d Limb	2 31 33.22			B
"	γ Ceti	2 35 03.68	03.92	+ 0.24	"
"	ε Arietis	2 50 07.98	07.49	— 0.49	"
"	α Ceti	2 53 58.54	58.16	— 0.38	"
"	δ Arietis	3 02 32.46	32.23	— 0.23	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A.R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1840, Aug. 19	ε Arietis	2 50 07.75	07.49	— 0.26	B
"	α Ceti	2 53 57.97	58.19	+ 0.22	"
"	δ Arietis	3 02 32.36	32.27	— 0.09	"
"	☽'s 2d Limb	3 31 46.95			"
20	☽'s 2d Limb	4 36 20.36			W
"	β Orionis	5 06 53.18	53.08	— 0.10	"
Sept. 3	☽'s 1st Limb	16 34 53.14			B
"	μ^1 Sagittarii	18 04 15.36	15.35	— 0.01	"
7	h^2 Sagittarii	19 27 02.20	02.16	— 0.04	"
"	57 Sagittarii	19 42 58.23	57.83	— 0.40	"
"	☽'s 1st Limb	20 14 02.34			"
"	π Capricorni	20 18 14.15	13.58	— 0.57	"
"	ν Capricorni	20 31 00.24	00.44	+ 0.20	"
15	ε Arietis	2 50 08.50	08.30	— 0.20	"
"	α Ceti	2 53 59.23	58.94	— 0.29	"
"	☽'s 2d Limb	3 13 08.61			"
"	α Tauri	4 26 47.87	48.16	+ 0.29	"
Oct. 5	c Sagittarii	19 52 52.42	52.68	+ 0.26	W
"	α^2 Capricorni	20 09 13.98	13.92	— 0.06	"
"	β^2 Capricorni	20 12 04.67	04.68	+ 0.01	"
"	☽'s 1st Limb	20 42 52.36			"
"	η Capricorni	20 55 21.44	21.59	+ 0.15	"
"	ε Capricorni	21 06 56.92	57.20	+ 0.28	"
"	β Aquarii	21 23 11.90	11.71	— 0.19	"
6	α^2 Capricorni	20 09 13.93	13.90	— 0.03	"
"	ε Capricorni	21 06 56.97	57.19	+ 0.22	"
"	β Aquarii	21 23 11.50	11.70	+ 0.20	"
"	☽'s 1st Limb	21 33 02.31			"
"	δ Capricorni	21 38 16.19	16.14	— 0.05	"
"	ι Aquarii	21 57 51.40	51.51	+ 0.11	"
7	α^2 Capricorni	20 09 13.88	13.89	+ 0.01	"
"	β Aquarii	21 23 11.79	11.69	— 0.10	"
"	δ Capricorni	21 38 16.34	16.12	— 0.22	"
"	ι Aquarii	21 57 51.52	51.50	— 0.02	"
"	☽'s 1st Limb	22 22 09.64			"
"	η Aquarii	22 27 11.92	11.95	+ 0.03	"
"	λ Aquarii	22 44 19.64	19.98	+ 0.34	"
8	α^2 Capricorni	20 09 13.94	13.88	— 0.06	B
"	α Aquarii	21 57 37.71	37.65	— 0.06	"
"	ζ Pegasi	22 33 32.72	32.75	+ 0.03	"
"	η Aquarii	22 27 11.73	11.94	+ 0.21	"
"	λ Aquarii	22 44 20.18	19.97	— 0.21	"
"	Fomalhaut	22 48 52.46	52.25	— 0.21	"
"	☽'s 1st Limb	23 11 05.04			"
"	λ Piscium	23 33 57.19	57.34	+ 0.15	"
9	κ^1 Piscium	23 18 47.92	47.98	+ 0.06	"
"	λ Piscium	23 33 57.09	57.34	+ 0.25	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1840, Oct. 9	☽'s 1st Limb	0 00 55.44			B
"	B Piscium	0 06 49.10	48.26	— 0.84	"
10	ζ Pegasi	22 33 32.74	32.74	0.00	W
"	Fomalhaut	22 48 52.32	52.24	— 0.08	"
"	α Pegasi	22 56 51.77	51.53	— 0.24	"
"	ι Piscium	23 31 47.34	47.28	— 0.06	"
"	B Piscium	0 06 48.62	48.26	— 0.36	"
"	☽'s 1st Limb	0 52 52.44			"
"	☽'s 2d Limb	0 55 07.92			"
"	ϑ^1 Ceti	1 16 05.55	05.87	+ 0.32	"
"	η Piscium	1 23 00.15	00.14	— 0.01	"
12	ϑ^1 Ceti	1 16 05.90	05.89	— 0.01	B
"	☽'s 2d Limb	2 59 07.19			"
"	α Ceti	2 53 58.73	59.49	— 0.24	"
"	g Arietis	3 14 56.25	56.63	+ 0.38	"
"	δ Arietis	4 02 33.73	33.68	— 0.05	"
13	γ Pegasi	0 05 04.42	04.28	— 0.14	W
"	δ Arietis	3 02 33.71	33.69	— 0.02	"
"	g Arietis	3 14 57.01	56.65	— 0.36	"
"	η Tauri	3 38 03.43	03.58	+ 0.15	"
"	☽'s 2d Limb	3 54 10.24			"
"	υ^1 Tauri	4 16 48.75	48.51	— 0.24	"
"	α Tauri	4 26 48.77	48.95	+ 0.18	"
"	τ Tauri	4 32 43.22	43.24	+ 0.02	"
"	β Tauri	5 16 15.38	15.33	— 0.05	"
15	β Tauri	5 16 15.46	15.41	— 0.05	"
"	l Aurigæ	5 28 26.47	26.20	— 0.27	"
"	☽'s 2d Limb	6 09 22.90			"
"	μ^1 Geminorum	6 13 20.86	20.84	— 0.02	"
16	☽'s 2d Limb	7 15 13.56			B
"	α^2 Geminorum	7 24 26.65	27.00	+ 0.35	"
"	β Geminorum	7 36 35.02	34.83	— 0.19	"
Nov. 1	☽'s 1st Limb	20 17 10.41			"
"	γ Capricorni	21 31 16.49	16.83	+ 0.34	"
"	ε Pegasi	21 36 23.05	22.91	— 0.14	"
"	δ Capricorni	21 38 15.84	15.80	— 0.04	"
2	α^2 Capricorni	20 10 13.75	13.50	— 0.25	W
"	☽'s 1st Limb	21 10 58.93			"
"	γ Capricorni	21 31 16.95	16.82	— 0.13	"
"	ε Pegasi	21 36 23.00	22.96	— 0.04	"
"	δ Capricorni	21 38 16.17	15.78	— 0.39	"
"	α Aquarii	21 57 37.30	37.36	+ 0.06	"
6	ι Piscium	23 31 47.18	47.13	— 0.05	"
"	η Piscium	23 39 46.98	46.53	— 0.45	"
"	α Piscium	23 51 09.78	09.77	— 0.01	"
"	γ Pegasi	0 05 04.00	04.21	+ 0.21	"
"	☽'s 1st Limb	0 26 03.90			"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1840, Nov. 13	Procyon	7 30 59.50	59.39	—0.11	B
"	β Geminorum	7 35 35.62	35.84	+0.22	"
"	☽'s 2d Limb	7 56 24.64			"
"	ϑ Cancri	8 22 31.98	32.10	+0.12	"
30	☽'s 1st Limb	21 40 04.00			"
"	α Aquarii	21 57 37.16	37.02	—0.14	"
"	ζ Pegasi	0 05 03.48	04.02	+0.54	"
"	ι Piscium	23 31 47.06	46.90	—0.16	"
Dec. 1	μ Capricorni	21 44 37.30	37.24	—0.06	"
"	30 Aquarii	21 54 54.31	54.35	+0.04	"
"	☽'s 1st Limb	22 26 51.18			"
"	λ Aquarii	22 44 19.47	19.42	—0.05	"
"	Fomalhaut	22 48 51.60	51.57	—0.03	"
"	α Pegasi	22 56 51.06	51.02	—0.04	"
2	β Aquarii	21 23 11.05	11.00	—0.05	W
"	ε Pegasi	21 26 22.48	22.52	+0.04	"
"	$\varkappa$ Aquarii	22 29 30.67	31.56	—0.11	B
"	ζ Pegasi	22 33 32.27	32.16	—0.11	"
"	λ Aquarii	22 43 19.42	19.41	—0.01	"
"	Fomalhaut	22 48 51.34	51.56	+0.22	"
"	☽'s 2d Limb	23 13 31.99			"
"	$\varkappa$ Piscium	23 18 47.51	47.53	+0.02	"
"	λ Piscium	23 33 56.62	56.94	+0.32	"
8	υ^1 Tauri	4 16 49.67	49.54	—0.13	"
"	α Tauri	4 26 50.05	49.99	—0.06	"
"	τ Tauri	4 32 44.28	44.36	+0.08	"
"	☽'s 1st Limb	5 02 19.53			"
"	☽'s 2d Limb	5 04 48.30			"
"	β Tauri	5 16 16.56	16.75	+0.19	"
"	C Tauri	5 43 21.87	22.16	+0.29	"
10	ε Geminorum	6 34 10.70	10.88	+0.18	W
"	ζ Geminorum	6 54 42.28	42.48	+0.20	"
"	☽'s 2d Limb	7 26 32.55			"
"	Procyon	7 31 00.25	00.12	—0.13	"
"	β Geminorum	7 35 36.68	36.67	—0.01	"
"	φ Geminorum	7 43 47.45	47.48	+0.03	"
11	δ Geminorum	7 10 39.22	39.31	+0.09	B
"	α^2 Geminorum	7 24 28.81	28.90	+0.09	"
"	β Geminorum	7 35 37.00	36.70	—0.30	"
"	φ Geminorum	7 43 47.95	47.51	—0.44	"
"	☽'s 2d Limb	8 31 05.76			"
"	δ Cancri	8 35 40.69	40.06	—0.63	"
"	o^2 Cancri	8 48 43.13	42.76	+0.37	"
14	d Leonis	10 52 21.75	21.70	—0.05	"
"	δ Leonis	11 05 39.66	39.49	—0.17	"
"	δ Hydræ et Crateris	11 11 24.66	24.42	—0.24	"
"	☽'s 2d Limb	11 13 41.43			"

Date.		Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
			h.	m.	s.	s.	s.	
1840, Dec.	14	τ Leonis	11	19	46.46	46.30	—0.16	B
	"	β Virginis	11	42	25.32	25.52	+0.20	"
	15	β Virginis	11	42	25.52	25.55	+0.03	"
	"	☽'s 2d Limb	12	11	41.43			"
	17	α Virginis	13	16	49.46	49.45	—0.01	"
	"	☽'s 2d Limb	13	36	47.26			"
	18	☽'s 2d Limb	14	25	59.98			"
	"	α Serpentis	15	36	25.80	25.80	0.00	"
	28	☽'s 1st Limb	22	10	45.10			W
	"	γ Ceti	2	35	05.36	05.47	+0.11	"
1841, Jan.	2	α Arietis	1	58	14.44	14.36	—0.08	B
	"	ϑ Arietis	2	09	18.60	18.76	+0.16	"
	"	☽'s 1st Limb	2	16	04.49			"
	"	ψ Arietis	2	23	07.07	06.71	—0.36	"
	"	γ Ceti	2	35	05.71	05.43	—0.28	"
	"	α Ceti	2	53	59.74	59.91	+0.17	"
	"	η Tauri	3	38	04.19	04.38	+0.19	"
	"	F Pleiadum	3	39	44.70	44.80	+0.10	"
	4	η Tauri	3	38	04.37	04.38	+0.01	W
	"	γ^1 Eridani	3	50	38.36	38.50	+0.14	"
	"	A^1 Tauri	3	55	19.85	19.94	+0.09	"
	"	υ^1 Tauri	4	16	50.25	49.59	—0.66	"
	"	☽'s 1st Limb	4	23	23.40			"
	"	α Tauri	4	26	50.25	50.09	—0.16	"
	30	☽'s 1st Limb	2	51	51.62			B
	"	δ Arietis	3	02	34.32	33.89	—0.43	"
	"	α Tauri	4	26	50.08	49.91	+0.17	"
	"	g Arietis	3	14	57.36	56.96	—0.40	"
	"	β Orionis	5	06	55.54	55.72	+0.18	"
	"	β Tauri	5	16	16.92	16.90	—0.02	"
	"	δ Orionis	5	28	10.81	10.80	—0.01	"
	31	υ^1 Tauri	4	16	49.30	49.40	+0.10	"
	"	β Tauri	5	16	17.08	16.89	—0.19	"
	"	☽'s 1st Limb	5	53	38.47			"
	"	α Tauri	4	26	49.97	49.90	—0.07	"
	"	τ Tauri	4	32	44.09	44.29	+0.20	"
	"	Capella	5	04	59.53	59.65	+0.12	"
	"	Rigel	5	06	55.47	55.74	+0.27	"
	"	δ Orionis	5	23	54.97	55.05	+0.08	"
	"	α Leporis	5	25	45.33	45.02	—0.31	"
	"	ε Orionis	5	28	10.57	10.79	+0.22	"
	"	α Orionis	5	46	36.12	35.99	—0.13	"
Feb.	2	α Tauri	4	26	49.77	49.87	+0.10	W
	"	Capella	5	04	59.71	59.62	—0.09	"
	"	Rigel	5	06	55.69	55.72	+0.03	"
	"	β Tauri	5	16	16.95	16.87	—0.08	"
	"	δ Orionis	5	23	55.01	55.03	+0.02	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1841, Feb. 2	ε Orionis	5 28 10.78	10.77	—0.01	W
"	☽'s 1st Limb	6 09 19.37			"
3	μ Geminorum	6 13 22.75	22.78	+0.03	B
"	ε Geminorum	6 36 11.36	11.37	+0.01	"
"	Sirius	6 38 10.16	10.57	+0.41	"
"	☽'s 1st Limb	7 18 02.31			"
"	α^2 Geminorum	7 24 29.83	29.69	—0.14	"
"	Procyon	7 31 00.80	00.82	+0.02	"
"	β Geminorum	7 35 37.44	37.52	+0.08	"
4	Procyon	7 31 00.91	00.82	—0.09	W
"	β Geminorum	7 35 37.51	37.52	+0.01	"
"	15 Argus	8 00 48.77	48.78	+0.01	"
"	☽'s 1st Limb	8 23 34.10			"
"	δ Cancri	8 35 41.15	41.23	+0.08	"
"	ε Hydræ	8 38 23.70	23.67	—0.03	"
"	α^2 Cancri	8 49 49.85	49.61	—0.24	"
6	ο Leonis	9 32 42.17	42.20	+0.03	B
"	α Leonis	9 59 56.81	56.52	—0.29	"
"	☽'s 2d Limb	10 23 26.72			"
"	48 Leonis	10 26 32.78	32.65	—0.13	"
"	d Leonis	10 52 23.30	23.18	—0.12	"
7	d Leonis	10 52 23.00	23.20	+0.20	"
"	δ Leonis	11 05 41.12	41.12	0.00	"
"	☽'s 2d Limb	11 16 34.18			"
"	υ Leonis	11 28 50.70	50.69	—0.01	"
"	β Virginis	11 42 26.96	27.17	+0.21	"
8	β Virginis	11 40 16.72			W
"	☽'s 2d Limb	12 05 25.70			"
"	η Virginis	12 09 38.40			"
"	γ^1 Virginis	12 31 29.14			"
12	α Tauri	4 26 49.91	49.74	—0.17	"
"	Capella	5 04 59.18	59.44	+0.26	"
"	Rigel	5 06 55.60	55.59	—0.01	"
"	β Tauri	5 16 16.57	16.74	+0.17	"
"	α Leporis	5 25 44.85	44.86	+0.01	"
"	α Columbæ	5 33 55.33	55.33	0.00	"
"	α Orionis	5 46 35.92	35.88	—0.04	"
"	☽'s 2d Limb	15 32 39.89			B
"	α Serpentis	15 36 27.49	27.38	—0.11	"
"	δ Scorpii	15 50 58.04	57.61	—0.43	"
"	ω Scorpii	15 58 07.10	06.48	—0.62	"
"	α Scorpii	16 19 41.09	40.94	—0.15	"
28	α Tauri	4 26 49.41	49.51	+0.10	"
"	☽'s 1st Limb	4 36 39.78			"
"	β Orionis	5 06 55.45	55.32	—0.13	"
"	β Tauri	5 16 16.41	16.48	+0.07	"
"	δ Orionis	5 23 54.76	54.68	—0.08	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1841, Feb. 28	α Leporis	5 25 44.02	44.60	+ 0.58	B
"	ε Orionis	5 28 10.32	10.43	+ 0.11	"
"	α Columbæ	5 33 55.99	54.99	— 1.00	"
"	μ Geminorum	6 13 22.70	22.50	— 0.20	"
"	Sirius	6 38 10.20	10.29	+ 0.09	"
March 1	α Tauri	4 26 49.62	49.48	— 0.14	"
"	Capella	5 04 58.71	59.06	+ 0.35	"
"	β Orionis	5 06 55.20	55.32	+ 0.12	"
"	β Tauri	5 16 16.53	16.47	— 0.06	"
"	δ Orionis	5 23 54.94	54.67	— 0.27	"
"	ε Orionis	5 28 10.61	10.42	— 0.19	"
"	α Columbæ	5 33 55.03	54.97	— 0.06	"
"	κ Aurigæ	6 05 16.84	16.90	+ 0.06	"
"	☽'s 1st Limb	5 42 56.86			"
2	Capella	5 04 59.11	59.04	— 0.07	"
"	β Tauri	5 16 16.67	16.45	— 0.22	"
"	δ Orionis	5 23 54.37	54.65	+ 0.28	"
"	α Leporis	5 25 44.33	44.56	+ 0.23	"
"	ε Orionis	5 28 10.22	10.40	+ 0.18	"
"	$α^2$ Geminorum	7 24 29.58	29.50	— 0.08	"
"	α Orionis	5 46 35.84	35.63	— 0.21	"
"	κ Aurigæ	6 05 16.72	16.90	+ 0.18	"
"	☽'s 1st Limb	6 49 42.96			"
"	C Tauri	5 43 21.71	22.02	+ 0.31	"
"	δ Geminorum	7 10 39.82	39.77	— 0.05	"
4	α Tauri	4 26 49.48	49.43	— 0.05	"
"	Sirius	6 38 10.32	10.23	— 0.09	"
"	$α^2$ Geminorum	7 24 29.62	29.46	— 0.16	"
"	Procyon	7 31 00.57	00.63	+ 0.06	"
"	β Geminorum	7 35 37.43	37.33	— 0.10	"
"	15 Argus	8 00 48.27	48.59	+ 0.32	"
"	λ Cancri	8 11 07.01	06.63	— 0.38	"
"	ϑ Cancri	8 22 33.96	33.95	— 0.01	"
"	☽'s 1st Limb	8 55 45.76			"
"	q Cancri	9 10 08.52	08.51	— 0.01	"
"	ξ Leonis	9 23 24.56	24.92	+ 0.36	"
5	δ Orionis	5 23 54.62	54.58	— 0.04	W
"	α Leporis	5 25 44.36	44.48	+ 0.12	"
"	ε Orionis	5 28 10.30	10.33	+ 0.03	"
"	α Columbæ	5 33 54.86	54.86	0.00	"
"	α Orionis	5 46 35.74	35.58	— 0.16	"
"	ε Hydræ	8 39 23.40	23.68	+ 0.28	"
"	ι Urs. Maj.	8 48 21.10	21.09	— 0.01	"
"	α Hydræ	9 19 48.80	48.87	+ 0.07	"
"	ξ Leonis	9 23 25.00	24.92	— 0.08	"
"	ε Leonis	9 36 52.03	51.85	— 0.18	"
"	☽'s 1st Limb	9 53 11.98			"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A.R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1841, March 5	α Leonis	9 59 56.56	56.70	+ 0.14	W
13	α Scorpii	16 19 41.95	42.10	+ 0.15	B
"	☽'s 2d Limb	16 59 49.77			"
"	α Herculis	17 07 25.55	25.41	— 0.14	"
"	ϑ Ophiuchi	17 12 16.87	16.66	— 0.21	"
"	e^2 Ophiuchi	17 21 45.13	44.74	— 0.39	"
"	α Lyræ	18 31 33.29	33.72	+ 0.43	"
14	☽'s 2d Limb	17 55 24.28			"
"	α Lyræ	18 31 33.68	33.76	+ 0.08	"
"	Altair	19 43 02.14	02.06	— 0.08	"
15	β Orionis	5 06 55.05	55.08	+ 0.03	"
"	β Tauri	5 16 16.15	16.22	+ 0.07	"
"	δ Orionis	5 23 54.37	54.43	+ 0.06	"
"	α Leporis	5 25 44.29	44.31	+ 0.02	"
"	ε Orionis	5 28 10.17	10.18	+ 0.01	"
30	Sirius	6 38 09.95	09.79	— 0.16	W
"	ξ Geminorum	6 54 42.73	42.37	— 0.36	"
"	δ Geminorum	7 10 39.39	39.32	— 0.07	"
"	α^2 Geminorum	7 24 28.69	29.03	+ 0.34	"
"	☽'s 1st Limb	7 33 15.55			"
"	β Geminorum	7 35 36.99	36.92	— 0.07	"
April 1	Capella	5 04 58.43	58.35	— 0.08	"
"	β Orionis	5 06 54.63	54.79	+ 0.16	"
"	ε Orionis	5 28 09.95	09.90	+ 0.05	"
"	☽'s 1st Limb	9 31 11.50			"
"	α Leonis	9 59 56.61	56.58	— 0.03	"
3	ε Leonis	9 36 51.65	51.64	— 0.01	"
"	χ Leonis	10 56 51.29	51.31	+ 0.02	"
"	δ Leonis	11 15 41.53	41.50	— 0.03	"
"	☽'s 1st Limb	11 16 43.18			"
"	β Virginis	11 42 27.66	27.73	+ 0.07	"
14	α Cygni	20 36 00.86	01.21	+ 0.35	"
"	☽'s 2d Limb	21 01 52.88			"
"	α Cephei	21 14 45.85	45.75	— 0.10	"
"	α Orionis	5 46 35.29	34.95	— 0.34	"
28	☽'s 1st Limb	9 13 56.79			"
"	ξ Leonis	9 23 24.27	24.36	+ 0.09	"
"	o Leonis	9 32 41.76	41.78	+ 0.02	"
"	ε Leonis	9 36 51.36	51.29	— 0.07	"
"	α Leonis	9 59 56.32	56.40	+ 0.08	"
May 3	β Leonis	11 40 59.51	59.44	— 0.07	"
"	β Corvi	12 26 05.44	05.48	+ 0.04	"
"	ψ Virginis	12 46 08.21	08.36	+ 0.15	"
"	12 Can. Ven.	12 48 38.13	38.24	+ 0.11	"
"	ϑ Virginis	13 01 46.62	46.39	— 0.23	"
"	α Virginis	13 16 52.05	52.36	+ 0.31	"
"	☽'s 1st Limb	13 29 00.52			"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1841, May 3	x Virginis	13	41	17.40	17.35	— 0.05	W
"	η Bootis	13	47	09.95	09.88	— 0.07	"
6	β Libræ	15	08	30.32	30.59	+ 0.27	"
"	α Cor. Bor.	15	28	00.60	00.41	— 0.19	"
"	$\varkappa$ Libræ	15	32	50.84	51.07	+ 0.23	"
"	α Serpentis	15	36	29.54	29.36	— 0.18	"
"	π Scorpii	15	49	17.98	18.14	+ 0.16	"
"	β^1 Scorpii	15	56	15.52	15.28	— 0.24	"
"	☽'s 2d Limb	16	12	51.02			"
"	Antares	16	19	43.54	43.52	— 0.02	"
8	β Leonis	11	40	59.45	59.40	— 0.05	"
"	γ Urs. Maj.	11	45	29.87	29.98	+ 0.11	"
"	β Corvi	12	26	05.45	05.46	+ 0.01	"
"	12 Can. Ven.	12	48	38.05	38.19	+ 0.14	"
"	α Herculis	17	07	26.99	26.82	— 0.17	B
"	3 Sagittarii	17	37	36.91	36.60	— 0.31	"
"	☽'s 2d Limb	18	05	20.55			"
"	λ Sagittarii	18	18	12.62	12.70	+ 0.08	"
"	φ Ophiuchi	18	35	46.55	46.44	— 0.11	"
11	α Cephei	21	14	47.15	47.15	0.00	"
"	☽'s 2d Limb	20	41	49.80			"
"	Fomalhaut	22	48	52.59	52.59	0.00	"
28	Procyon	7	30	59.19	59.54	+ 0.35	W
"	α Hydræ	9	19	47.86	47.91	+ 0.05	"
"	α Leonis	9	59	55.93	56.04	+ 0.11	"
"	α Urs. Maj.	10	53	55.09	55.01	— 0.08	"
"	δ Leonis	11	05	41.39	40.98	— 0.41	"
"	☽'s 1st Limb	11	33	45.74			"
"	β Virginis	11	42	27.39	27.41	+ 0.02	"
"	γ Urs. Maj.	11	45	29.75	29.52	— 0.23	"
31	α Leonis	9	59	56.04	55.90	— 0.14	"
"	β Leonis	11	40	59.04	59.19	+ 0.15	"
"	β Corvi	12	26	05.38	05.31	— 0.07	"
"	12 Can. Ven.	12	48	37.94	37.95	+ 0.01	"
"	☽'s 1st Limb	14	03	09.87			"
June 1	12 Can. Ven.	12	48	37.79	37.94	+ 0.15	"
"	Spica	13	16	52.43	52.30	— 0.13	"
"	η Bootis	13	47	09.94	09.83	— 0.11	"
"	α Bootis	14	08	27.45	27.65	+ 0.20	"
"	λ Virginis	14	10	34.61	34.26	— 0.35	"
"	α^2 Libræ	14	42	08.94	08.86	— 0.08	"
"	☽'s 1st Limb	14	55	47.58			"
"	ι^1 Libræ	15	03	13.70	13.63	— 0.07	"
"	β Libræ	15	08	30.70	30.78	+ 0.08	"
2	ι^1 Libræ	15	03	13.82	13.63	— 0.19	"
"	β Libræ	15	08	30.64	30.78	+ 0.14	"
"	γ^1 Libræ	15	26	41.60	41.84	+ 0.24	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A.R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1841, June 2	α Serpentis	15 36 29.53	29.60	+ 0.07	W
"	☽'s 1st Limb	15 50 21.18			"
"	β¹ Scorpii	15 56 15.55	15.63	+ 0.08	"
"	δ Ophiuchi	16 06 03.97	04.54	+ 0.57	"
3	η Urs. Maj.	13 41 19.30	19.35	+ 0.05	"
"	η Bootis	13 47 09.92	09.82	— 0.10	"
"	β Libræ	15 08 30.77	30.79	+ 0.02	"
"	α Cor. Bor.	15 28 00.45	00.58	+ 0.13	"
"	β¹ Scorpii	15 56 15.63	15.63	0.00	"
"	Antares	16 19 44.04	43.93	— 0.11	"
"	☽'s 1st Limb	16 46 15.98			"
"	☽'s 2d Limb	16 48 35.22			"
"	η Ophiuchi	17 01 19.38	19.51	+ 0.13	"
"	α Herculis	17 07 27.24	27.23	— 0.01	"
"	ϑ Ophiuchi	17 12 18.84	18.82	— 0.02	"
"	α Ophiuchi	17 27 36.52	36.54	+ 0.02	"
6	δ Aquilæ	19 17 31.94	31.96	+ 0.02	B
"	h² Sagittarii	19 27 05.57	05.37	— 0.20	"
"	☽'s 2d Limb	19 32 56.64			"
"	γ Aquilæ	19 38 44.81	44.95	+ 0.14	"
"	α Aquilæ	19 43 04.57	04.48	— 0.09	"
"	β Aquilæ	19 47 33.26	33.17	— 0.09	"
26	12 Can. Ven.	12 48 37.93	37.65	— 0.28	W
"	☽'s 1st Limb	12 56 53.44			"
"	Spica	13 16 52.14	52.13	— 0.01	"
"	η Urs. Maj.	13 41 18.94	18.91	— 0.03	"
"	Arcturus	14 08 27.64	27.53	— 0.11	"
"	ε Bootis	14 38 05.67	05.60	— 0.07	"
"	α² Libræ	14 42 08.62	08.82	+ 0.20	"
28	α Bootis	14 08 27.73	27.51	— 0.22	"
"	☽'s 1st Limb	14 39 19.32			"
"	α² Libræ	14 42 08.89	08.82	— 0.07	"
"	20 Libræ	14 54 50.08	50.45	+ 0.37	B
"	ι¹ Libræ	15 03 13.57	13.61	+ 0.04	"
"	β Libræ	15 08 30.79	30.79	0.00	"
"	α Cor. Bor.	15 28 00.50	00.50	0.00	"
29	α Cor. Bor.	15 28 00.66	00.49	— 0.17	W
"	☽'s 1st Limb	15 32 48.38			"
"	α Serpentis	15 36 29.39	29.62	+ 0.23	"
"	β Scorpii	15 41 29.01	29.41	+ 0.40	"
"	Antares	16 19 44.17	44.12	— 0.05	"
30	α Scorpii	16 19 44.12	44.12	0.00	B
"	☽'s 1st Limb	16 27 57.26			"
July 1	☽'s 1st Limb	17 23 50.35			W
"	D Ophiuchi	17 33 58.23	58.55	+ 0.32	"
"	β Libræ	15 08 30.66	30.76	+ 0.10	"
"	α Cor. Bor.	15 28 00.59	00.47	— 0.12	"

Date.		Name of Object.	Sidereal Time of Meridian Passage. h.	m.	s.	Seconds of Tabular A.R. s.	Diff. s.	Observer's initial.
1841, July	1	α Serpentis	15	36	29.71	29.60	—0.11	W
	"	δ Ophiuchi	16	06	04.73	04.63	—0.10	"
	"	ε Scorpii	16	26	03.78	03.80	+0.02	"
	"	Antares	16	19	43.98	44.12	+0.14	"
	2	α Cor. Bor.	15	28	00.48	00.46	—0.02	B
	"	α Serpentis	15	39	29.62	29.60	—0.02	"
	"	β Scorpii	15	56	15.69	15.72	+0.03	"
	"	δ Ophiuchi	16	06	04.59	04.62	+0.03	"
	"	α Herculis	17	07	27.46	27.42	—0.04	"
	"	α Ophiuchi	17	27	36.79	36.78	—0.01	"
	"	D Ophiuchi	17	33	58.81	58.55	—0.26	"
	"	3 Sagittarii	17	37	38.00	37.76	—0.24	"
	"	☽'s 1st Limb	18	19	13.27			"
	"	φ Sagittarii	18	35	47.69	47.71	+0.02	"
	"	σ Sagittarii	18	45	29.12	28.67	—0.45	"
	8	η Aquarii	22	27	14.30	14.40	+0.10	"
	"	ζ Pegasi	22	33	35.12	35.10	—0.02	"
	"	Fomalhaut	22	48	54.52	54.59	+0.07	"
	"	α Pegasi	22	56	53.64	53.70	+0.06	"
	"	$\varkappa^1$ Piscium	23	18	50.15	50.02	—0.13	"
	"	☽'s 2d Limb	23	11	56.35			"
	"	ι Piscium	23	31	49.44	49.22	—0.22	"
	"	α Andromedæ	0	0	13.49	13.41	—0.08	"
	10	α Andromedæ	0	0	13.45	13.48	+0.03	"
	"	γ Pegasi	0	05	06.21	06.06	—0.15	"
	"	α Cassiopeæ	0	31	33.67	33.81	+0.14	"
	"	☽'s 2d Limb	0	44	04.92			"
	11	α Cassiopeæ	0	31	33.90	33.90	0.00	"
	"	β Ceti	0	35	39.02	39.03	—0.01	"
	"	☽'s 2d Limb	1	34	08.00			"
	22	☽'s 1st Limb	11	47	13.40			"
	"	α^2 Libræ	14	42	08.34	08.61	+0.27	"
	"	β Libræ	15	08	30.70	30.61	—0.09	"
	"	α Cor. Bor.	15	28	00.28	00.24	—0.04	"
	"	α Serpentis	15	36	29.59	29.45	—0.14	"
	26	β Libræ	15	08	30.58	30.56	—0.02	"
	"	☽'s 1st Limb	15	15	23.99			"
	"	β^1 Scorpii	15	56	15.52	15.47	—0.05	"
	"	δ Ophiuchi	16	06	04.48	04.49	+0.01	"
	"	α Scorpii	16	19	43.90	44.00	+0.10	"
	27	ε Bootis	14	38	05.07	05.20	+0.13	"
	"	α Cor. Bor.	15	28	00.28	00.18	—0.10	"
	"	α Serpentis	15	36	29.44	29.41	—0,03	"
	"	π Scorpii	15	49	18.28	18.38	+0.10	"
	"	β^1 Scorpii	15	56	15.82	15.58	—0.24	"
	"	δ Ophiuchi	16	06	04.53	04.48	—0.05	"
	"	☽'s 1st Limb	16	10	18.16			"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A.R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1841, July 27	Antares	16	19	43.66	43.99	+ 0.33	B
29	ϑ Ophiuchi	17	12	18.81	19.09	+ 0.28	"
"	α Ophiuchi	17	27	36.73	36.73	0.00	"
"	D Ophiuchi	17	33	58.09	58.34	+ 0.25	"
"	3 Sagittarii	17	37	37.63	37.61	— 0.02	"
"	☽'s 1st Limb	18	01	27.48			"
30	δ Ophiuchi	16	06	04.48	04.45	— 0.03	"
"	σ Scorpii	16	11	35.66	35.85	+ 0.19	"
"	α Scorpii	16	19	43.95	43.96	+ 0.01	"
"	α Herculis	17	07	27.42	27.31	— 0.11	"
"	ϑ Ophiuchi	17	12	19.10	19.09	— 0.01	"
"	3 Sagittarii	17	37	37.81	37.60	— 0.21	"
"	μ^1 Sagittarii	18	04	19.41	19.57	+ 0.16	"
"	☽'s 1st Limb	18	55	43.13			"
August 1	δ Ophiuchi	16	06	04.68	04.43	— 0.25	"
"	α Scorpii	16	19	44.09	43.94	— 0.15	"
"	β Lyræ	18	44	16.04	15.93	— 0.11	"
"	γ Aquilæ	19	38	45.72	45.74	+ 0.02	"
"	α Aquilæ	19	43	05.02	05.28	+ 0.26	"
"	h^2 Sagittarii	19	27	06.08	06.28	+ 0.20	"
"	π Sagittarii	19	00	22.78	22.84	+ 0.06	"
"	β Aquilæ	19	47	33.94	34.00	+ 0.06	"
"	c Sagittarii	19	52	57.14	57.19	+ 0.05	"
"	α^2 Capricorni	20	09	17.87	17.91	+ 0.04	"
"	β^2 Capricorni	20	12	08.63	08.72	+ 0.09	"
"	☽'s 1st Limb	20	37	38.36			"
"	☽'s 2d Limb	20	39	46.90			"
2	α Lyræ	18	31	36.44	36.47	+ 0.03	"
"	c Sagittarii	19	52	57.37	57.19	— 0.18	"
"	α^2 Capricorni	20	09	17.85	17.91	+ 0.06	"
"	β Lyræ	18	44	15.40	15.92	+ 0.52	"
"	π Sagittarii	19	00	22.78	22.84	+ 0.06	"
"	β^2 Capricorni	20	12	08.55	08.72	+ 0.17	"
"	β Aquarii	21	23	15.26	15.16	— 0.10	"
"	μ Capricorni	21	44	41.10	41.38	+ 0.28	"
"	☽'s 2d Limb	21	27	13.99			"
3	ν Aquarii	21	00	59.61	59.96	+ 0.35	"
"	ζ Cygni	21	06	13.94	13.94	0.00	"
"	ν Capricorni	21	31	21.07	20.76	— 0.31	"
"	μ Capricorni	21	44	41.92	41.38	— 0.54	"
"	☽'s 2d Limb	22	13	57.58			"
"	η Aquarii	22	27	15.20	14.99	— 0.21	"
9	γ Arietis	1	44	52.53	52.18	— 0.35	"
"	α Arietis	1	58	16.51	16.51	0.00	"
"	ϑ^1 Arietis	2	09	20.81	20.81	0.00	"
"	☽'s 2d Limb	3	04	19.75			"
23	☽'s 1st Limb	15	50	31.96			"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1841, Aug. 23	δ Ophiuchi	16	06	04.20	04.15	— 0.05	B
"	Antares	16	19	43.60	43.64	+ 0.04	"
"	A^1 Ophiuchi	17	05	38.14	38.59	+ 0.45	"
"	ϑ Ophiuchi	17	12	18.82	18.80	— 0.02	"
"	α Ophiuchi	17	27	36.38	36.45	+ 0.07	"
"	γ^2 Sagittarii	17	55	40.18	40.26	+ 0.08	"
"	μ^1 Sagittarii	18	04	19.46	19.38	— 0.08	"
25	α Ophiuchi	17	27	36.23	36.42	+ 0.19	W
"	☽'s 1st Limb	17	42	38.68			"
"	γ Draconis	17	52	57.31	57.24	— 0.07	"
"	μ^1 Sagittarii	18	04	19.18	19.35	+ 0.17	"
"	γ Aquilæ	19	38	45.88	45.66	— 0.22	"
"	α Aquilæ	19	43	05.28	05.23	— 0.05	"
"	β Aquilæ	19	47	33.96	33.95	— 0.01	"
Sept. 1	☽'s 2d Limb	23	28	16.07			B
"	ω Piscium	23	51	12.81	12.96	+ 0.15	"
"	α Andromedæ	0	00	14.89	14.81	— 0.08	"
"	α Cassiopeæ	0	31	35.99	35.82	— 0.17	"
"	β Ceti	0	35	40.57	40.41	— 0.16	"
"	δ Piscium	0	40	30.49	30.30	— 0.19	"
"	ε Piscium	0	55	46.00	45.85	— 0.15	"
"	ϑ Ceti	1	16	08.29	08.52	+ 0.23	"
2	☽'s 2d Limb	0	14	06.41			"
"	α Cassiopeæ	0	31	35.82	35.84	+ 0.02	"
"	β Ceti	0	35	39.82	40.43	+ 0.61	"
"	δ Piscium	0	40	30.07	30.31	+ 0.24	"
"	ϑ Ceti	1	16	08.29	08.54	+ 0.25	"
"	η Piscium	1	23	03.53	03.05	— 0.48	"
"	α Arietis	1	58	17.44	17.20	— 0.24	"
3	☽'s 2d Limb	1	01	43.53			"
"	ϑ Ceti	1	16	08.65	08.56	— 0.09	"
"	α Arietis	1	58	17.27	17.24	— 0.03	"
"	ϑ^1 Arietis	2	09	21.22	21.51	+ 0.29	"
"	ε Arietis	2	50	11.48	11.69	+ 0.21	"
"	α Ceti	2	54	01.88	02.00	+ 0.12	"
"	δ Arietis	3	02	36.75	36.44	— 0.31	"
"	α Persei	3	13	04.68	04.63	— 0.05	"
7	A^1 Tauri	3	55	21.59	21.83	+ 0.24	"
"	υ^1 Tauri	4	16	51.49	51.31	— 0.18	"
"	α Tauri	4	26	51.57	51.63	+ 0.06	"
"	☽'s 2d Limb	4	47	14.25			"
"	Capella	5	05	01.21	01.27	+ 0.06	"
"	β Tauri	5	16	18.34	18.23	— 0.11	"
20	☽'s 1st Limb	16	23	57.83			"
"	μ^1 Sagittarii	18	04	18.98	18.96	— 0.02	"
"	δ Sagittarii	18	10	53.03	52.84	— 0.19	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1841, Sept. 20	β Lyræ	18	44	15.14	15.15	+0.01	B
"	ϱ^1 Sagittarii	19	12	30.84	30.96	+0.12	"
"	δ Aquilæ	19	17	32.26	32.25	−0.01	"
"	h^2 Sagittarii	19	27	05.54	05.90	+0.36	"
21	η Ophiuchi	17	01	18.36	18.97	+0.61	"
"	☽'s 1st Limb	17	20	58.17			"
"	δ Aquilæ	19	17	32.23	32.24	+0.01	"
"	h^2 Sagittarii	19	27	06.04	05.91	−0.13	"
"	γ Aquilæ	19	38	45.12	45.35	+0.23	"
"	β Aquilæ	19	47	33.75	33 67	−0.08	"
"	α^2 Capricorni	20	09	17.96	17.70	−0.26	"
"	υ Capricorni	20	31	03.72	03.97	+0.25	"
"	α Cygni	20	37	03 00	03.75	+0.75	"
25	β Aquilæ	19	47	33 65	33.60	−0.05	W
"	α^2 Capricorni	20	09	17.47	17.65	+0.18	"
"	β Capricorni	20	12	08.35	08.46	+0.11	"
"	γ Capricorni	20	31	03.98	03.93	−0.05	"
"	α Cygni	20	36	03.80	03.66	−0.14	"
"	☽'s 1st Limb	20	51	17.04			"
"	ζ Pegasi	22	33	35.60	36.06	+0.46	"
26	γ Aquilæ	19	38	45.18	45.27	+0.09	"
"	α Aquilæ	19	43	04.74	04.85	+0.11	"
"	β Aquilæ	19	47	33.58	33.54	−0.04	"
"	α^2 Capricorni	20	09	17.68	17.64	−0.04	"
"	ζ Cygni	21	06	13.71	13.75	+0.04	"
"	c Capricorni	21	13	27.67	27.52	−0.15	"
"	β Aquarii	21	23	15.36	15.21	−0.15	"
"	ϵ Pegasi	21	36	26.55	26.54	−0.01	"
"	☽'s 1st Limb	21	40	22.86			"
"	ι Aquarii	21	57	55 29	55.07	−0.22	"
27	ι Capricorni	21	13	27.48	27.52	+0.04	B
"	β Aquarii	21	23	15.20	15.20	0.00	"
"	μ Capricorni	21	44	41.56	41.52	−0.04	"
"	ι Aquarii	21	57	55.25	55.07	−0.18	"
"	☽'s 1st Limb	22	24	11.92			"
"	χ Aquarii	22	44	23.34	23.39	+0.05	"
30	μ Capricorni	21	44	41.15	41.49	+0.34	"
"	ι Aquarii	21	57	54.83	55 07	+0.24	"
"	η Aquarii	22	27	15.33	15.33	0.00	"
"	$\varkappa^1$ Piscium	23	18	51.15	51.31	+0.16	"
"	ι Piscium	23	31	50.58	50.59	+0.01	"
"	α Andromdæ	0	0	15.08	15.09	+0.01	"
"	γ Pegasi	0	05	07.62	07.61	−0.01	"
"	☽'s 2d Limb	0	45	15.52			"
Oct. 1	ϵ Pegasi	21	36	26.59	26.49	−0.10	W
"	α Aquarii	21	57	41.06	41.03	−0.03	"

Date.		Name of Object.	Sidereal Time of Meridian Passage. h.	m.	s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1841, Oct.	1	Fomalhaut	22	48	55.98	55.79	— 0.19	W
	"	γ Pegasi	0	05	07.46	07.61	+ 0.15	"
	"	α Cassiopeæ	0	31	36.29	36.32	+ 0.03	"
	"	β Ceti	0	35	40.75	40.77	+ 0.02	"
	"	ε Piscium	0	54	45.86	46.29	+ 0.43	"
	"	ϑ Ceti	1	16	08.78	09.01	+ 0.23	"
	"	☽'s 2d Limb	1	35	28.44			"
	"	β Arietis	1	45	56.51	56.58	+ 0.07	"
	9	α^2 Geminorum	7	24	30.87	30.88	+ 0.01	B
	"	β Geminorum	7	35	38.59	38.56	— 0.03	"
	"	☽'s 2d Limb	9	37	35.43			"
	"	α Leonis	9	59	56.58	56.60	+ 0.02	"
	19	☽'s 1st Limb	17	53	28.72			"
	"	γ Aquilæ	19	38	44.91	44.88	— 0.03	"
	"	α Aquilæ	19	43	04.58	04.48	— 0.10	"
	"	α^2 Capricorni	20	09	17.10	17.28	+ 0.18	"
	"	α Cygni	20	36	03.29	03.09	— 0.20	"
	"	61′ Cygni	20	59	49.22	49.56	+ 0.34	"
	"	α Cephei	21	14	48.27	48.62	+ 0.35	"
	"	ζ Cygni	21	07	13.49	13.39	— 0.10	"
	"	β Aquarii	21	23	15.16	14.94	— 0.22	"
	"	β Cephei	21	26	36.72	36.52	— 0.20	"
	21	δ Aquilæ	19	17	31.75	31.75	0.00	W
	"	☽'s 1st Limb	19	41	30.29			"
	"	β Aquarii	21	23	15.06	14.95	— 0.11	"
	"	ε Pegasi	21	36	26.38	26.26	— 0.12	"
	"	α Pegasi	22	56	54.41	54.70	+ 0.29	"
	24	61′ Cygni	20	59	49.54	49.46	— 0.08	"
	"	ζ Cygni	21	06	13.16	13.28	+ 0.12	"
	"	β Aquarii	21	23	14.83	14.87	+ 0.04	B
	"	β Cephei	21	26	36.19	36.24	+ 0.05	"
	"	ε Pegasi	21	36	26.26	26.23	— 0.03	"
	"	α Aquarii	21	57	40.85	40.80	— 0.05	W
	"	☽'s 1st Limb	22	05	05.70			"
	"	ϑ Aquarii	22	08	30.40	30.33	— 0.07	"
	"	ζ Aquarii	22	20	42.55	42.51	— 0.04	"
	25	α Aquarii	21	57	40.65	40.79	+ 0.14	"
	"	ζ Aquarii	22	20	42.82	42.49	— 0.33	"
	"	ζ Pegasi	22	33	35.79	35.84	+ 0.05	"
	"	Fomalhaut	22	48	55.67	55.58	— 0.09	"
	"	☽'s 1st Limb	22	50	22.95			"
	"	β Piscium	22	55	51.18	51.25	+ 0.07	"
	"	γ Piscium	23	08	59.77	59.62	— 0.15	"
	"	γ Cephei	23	32	58.07	58.04	— 0.03	"
	27	β Aquilæ	19	47	33.22	33.07	— 0.15	"
	"	α^2 Capricorni	20	09	17.28	17.15	— 0.13	"
	"	ζ Aquilæ	21	06	13.03	13.23	+ 0.20	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1841, Oct. 27	α Cephei	21	14	48.27	48.26	—0.01	W
"	β Aquarii	21	23	14.93	14.82	—0.11	"
"	β Cephei	21	26	36.08	36.08	0.00	"
"	ζ Pegasi	22	33	35.97	35.82	—0.15	B
"	ε Pegasi	21	36	26.19	26.15	—0.04	W
"	Fomalhaut	22	48	55.53	55.55	+0.02	B
"	β Piscium	22	55	51.45	51.23	—0.22	"
"	γ Piscium	23	08	59.62	59.62	0.00	"
"	☽'s 1st Limb	0	22	57.70			"
"	δ Piscium	0	40	31.04	30.76	—0.28	"
"	η Piscium	1	23	03.77	03.73	—0.04	"
28	ω Piscium	23	51	13.36	13.15	—0.21	"
"	α Andromedæ	0	00	15.29	15.06	—0.23	"
"	γ Pegasi	0	05	07.56	07.61	+0.05	"
"	α Cassiopeæ	0	31	35.90	36.35	+0.45	"
"	β Ceti	0	35	41.10	40.83	—0.27	"
"	δ Piscium	0	40	30.76	30.76	0.00	W
"	☽'s 1st Limb	1	12	28.86			"
29	δ Aquilæ	19	17	30.90	31.63	+0.73	"
"	α^2 Capricorni	20	09	17.17	17.13	—0.04	"
"	61′ Cygni	20	59	49.28	49.36	+0.08	"
"	ζ Cygni	21	06	13.54	13.19	—0.35	"
"	α Cephei	21	15	48.17	48.14	—0.03	"
"	ω Piscium	23	51	12.94	13.13	+0.19	"
"	δ Piscium	0	40	30.35	30.76	+0.41	"
"	☽'s 1st Limb	2	04	33.49			"
"	☽'s 2d Limb	2	06	51.21			"
30	α Ceti	2	54	03.27	03.13	—0.14	B
"	☽'s 2d Limb	3	05	16.30			"
"	η Tauri	3	38	07.66	07.79	+0.13	"
Nov. 1	υ^1 Tauri	4	16	53.11	52.83	—0.28	"
"	α Tauri	4	26	53.08	53.10	+0.02	"
"	τ Tauri	4	32	47.76	47.60	—0.16	"
"	Capella	5	05	03.40	03.42	+0.02	"
"	☽'s 2d Limb	5	11	36.43			"
"	β Tauri	5	16	20.39	20.04	—0.35	"
"	α Columbæ	5	33	57.09	57.24	+0.15	"
"	C Tauri	5	43	25.52	25.27	—0.25	"
"	α Orionis	5	46	38.25	38.41	+0.16	"
2	Capella	5	05	03.47	03.46	—0.01	W
"	Rigel	5	06	57.70	57.21	—0.49	"
"	β Tauri	5	16	20.40	20.10	—0.30	"
"	δ Orionis	5	23	57.67	57.53	—0.14	"
"	α Leporis	5	26	46.90	47.17	+0.27	"
"	ε Orionis	5	28	13.18	13.45	+0.27	"
"	α Columbæ	5	33	57.38	57.26	—0.12	"
"	☽'s 2d Limb	5	17	12.85			"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1841, Nov. 2	α Orionis	5	46	38.55	38.44	— 0.11	W
"	Sirius	6	38	12.32	12.19	— 0.13	"
"	ζ Geminorum	6	54	44.94	45.19	+ 0.25	"
3	ε Geminorum	6	34	13.76	13.79	+ 0.03	B
"	ζ Geminorum	6	54	45.16	45.19	+ 0.03	"
"	δ Geminorum	7	10	41.99	42.03	+ 0.04	"
"	☽'s 2d Limb	7	21	20.68			"
"	β Geminorum	7	35	39.46	39.39	— 0.07	"
"	φ Geminorum	7	43	50.18	50.19	+ 0.01	"
6	ο Leonis	9	32	43.33	43.17	— 0.16	"
"	ε Leonis	9	36	52.80	52.70	— 0.10	"
"	α Leonis	9	59	57.24	57.36	+ 0.12	"
"	☽'s 2d Limb	10	14	07.82			"
"	α Urs. Maj.	10	53	55.06	55.24	+ 0.18	"
"	δ Leonis	11	05	41.81	41.59	— 0.22	"
17	☽'s 1st Limb	19	19	36.66			"
"	γ Aquilæ	19	38	44.42	44.47	+ 0.05	"
"	α Aquilæ	19	44	04.03	04.07	+ 0.04	"
"	α² Capricorni	20	09	16.97	16.88	— 0.09	"
18	γ Aquilæ	19	38	44.51	44.46	— 0.05	"
"	α Aquilæ	19	43	03.75	04.08	+ 0.33	"
"	☽'s 1st Limb	20	10	50.11			"
"	α Cygni	20	36	02.26	02.38	+ 0.12	"
"	61′ Cygni	20	59	48.63	48.96	+ 0.33	"
"	β Aquarii	21	23	14.87	14.54	— 0.33	"
"	α Cassiopeæ	0	31	36.41	36.12	— 0.29	"
"	β Ceti	0	35	40.19	40.72	+ 0.53	"
24	α Andromedæ	0	00	14.70	14.83	+ 0.13	"
"	γ Pegasi	0	05	07.56	07.43	— 0.13	"
"	☽'s 1st Limb	0	48	42.90			"
"	ϑ¹ Arietis	2	09	22.70	22.60	— 0.10	"
30	α Andromedæ	0	00	14.80	14.77	— 0.03	"
"	β Ceti	0	35	40.54	40.61	+ 0.07	"
"	γ Ceti	2	35	08.86	08.92	+ 0.06	"
"	α Orionis	5	46	38.94	39.08	+ 0.14	"
"	μ Geminorum	6	13	26.10	26.07	— 0.03	"
"	ε Geminorum	6	34	14.80	14.59	— 0.21	"
"	α Canis Maj.	6	38	12.99	12.90	— 0.09	"
"	☽'s 2d Limb	6	57	46.98			"
"	δ Geminorum	7	10	42.82	42.85	+ 0.03	"
"	α² Geminorum	7	24	32.50	32.67	+ 0.17	"
"	Procyon	7	31	03.36	03.23	— 0.13	"
"	β Geminorum	7	35	40.44	40.29	— 0.15	"
Dec. 4	ρ Leonis	10	24	30.39	30.14	— 0.25	"
"	☽'s 2d Limb	10	50	39.23			"
"	δ Leonis	11	05	42.42	42.54	+ 0.12	"
"	σ Leonis	11	12	59.88	59.93	+ 0.05	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1841, Dec. 4	β Leonis	11	41	00.41	00.30	— 0.11	B
"	β Virginis	11	42	28.39	28.49	+ 0.10	"
"	γ Urs. Maj.	11	45	30.26	30.30	+ 0.04	"
6	δ Leonis	11	05	42.76	42.58	— 0.18	"
"	σ Leonis	11	13	00.02	59.99	— 0.03	"
"	β Virginis	11	42	28.16	28.55	+ 0.39	"
"	γ Urs. Maj.	11	45	30.22	30.11	— 0.11	"
"	η Virginis	12	11	49.56	49.60	+ 0.04	"
"	β Corvi	12	26	05.66	05.98	+ 0.32	"
"	☽'s 2d Limb	12	32	51.89			"
7	η Virginis	12	11	50.20	49.63	— 0.57	"
"	β Corvi	12	26	05.90	06.01	+ 0.11	"
"	γ^1 Virginis	12	33	39.76	39.78	+ 0.02	"
"	12 Can. Ven.	12	48	37.82	37.86	+ 0.04	"
"	Spica	13	16	52.68	52.54	— 0.14	"
"	☽'s 2d Limb	13	23	33.57			"
19	☽'s 1st Limb	22	56	27.42			"
"	γ Piscium	23	08	58.99	59.04	+ 0.05	"
"	$\varkappa^1$ Piscium	23	18	50.77	50.65	— 0.12	"
"	α Andromedæ	0	00	14.54	14.53	— 0.01	"
"	β Ceti	0	35	40.29	40.41	+ 0.12	"
"	δ Piscium	0	40	30.65	30.44	— 0.21	"
"	ε Piscium	0	54	46.08	46.14	+ 0.06	"
"	α Arietis	1	58	18.26	18.13	— 0.13	"
22	δ Piscium	0	40	30.16	30.41	+ 0.25	"
"	ε Piscium	0	54	46.14	46.11	— 0.03	"
"	γ Ceti	2	35	08.72	08.86	+ 0.14	"
"	α Ceti	2	54	03.17	03.32	+ 0.15	"
"	☽'s 1st Limb	1	14	49.97			"
"	γ^1 Eridani	3	50	41.82	41.53	— 0.29	"
24	α Arietis	1	58	18.16	18.10	— 0.06	"
"	ϑ^1 Arietis	2	09	22.46	22.49	+ 0.03	"
"	γ Arietis	2	29	52.98	52.67	— 0.32	"
"	α Ceti	2	54	03.25	03.32	+ 0.07	"
"	☽'s 1st Limb	3	04	14.95			"
"	η Tauri	3	38	08.08	08.26	+ 0.18	"
"	γ^1 Eridani	3	50	41.62	41.53	— 0.09	"
"	μ^1 Tauri	4	16	53.63	53.48	— 0.15	"
"	α Tauri	4	26	53.90	53.78	— 0.12	"
28	α Tauri	4	26	53.81	53.79	— 0.02	"
"	β Tauri	5	16	20.76	21.08	+ 0.32	"
"	C Tauri	5	43	26.79	26.47	— 0.32	"
"	μ^1 Geminorum	6	13	26.78	26.58	— 0.20	"
"	ε Geminorum	6	34	15.44	15.16	— 0.28	"
"	α Canis Maj.	6	38	13.40	13.37	— 0.03	"
"	ζ Geminorum	6	54	46.64	46.64	0.00	"
"	☽'s 2d Limb	7	32	03.09			"

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			h.	m.	s.	s.	s.	
1841, Dec.	28	β Geminorum	7	35	41.12	41.04	— 0.08	B
	29	μ^1 Geminorum	6	13	26.54	26.55	+ 0.01	"
	"	ε Geminorum	6	34	15.14	15.17	+ 0.03	"
	"	Sirius	6	38	13.40	13.38	— 0.02	"
	"	ζ Geminorum	6	54	46.85	46.66	— 0.19	"
	"	Procyon	7	31	03.74	03.88	+ 0.14	"
	"	μ Cancri	7	56	58.74	58.68	— 0.06	"
	"	β Geminorum	7	35	41.05	41.06	+ 0.01	"
	"	☽'s 2d Limb	8	36	00.29			"
	"	α^2 Cancri	8	49	53.06	52.50	— 0.56	"
	31	Capella	5	05	04.82	04.60	— 0.22	"
	"	β Tauri	5	16	21.11	21.06	— 0.05	"
	"	δ Orionis	5	23	58.40	58.43	+ 0.03	"
	"	α Leporis	5	25	47.98	47.99	+ 0.01	"
	"	ε Orionis	5	28	14.06	14.14	+ 0.08	"
	"	α Orionis	5	46	39.60	39.50	— 0.10	"
	"	ε Geminorum	6	34	15.20	15.19	— 0.01	"
	"	Sirius	6	38	13.44	13.42	— 0.02	"
	"	ν Leonis	9	49	45.04	45.09	+ 0.05	"
	"	α Leonis	9	59	58.93	59.13	+ 0.20	"
	"	☽'s 2d Limb	10	31	34.38			"
	"	34 Sextantis	10	34	29.16	28.04	— 1.12	"
	"	δ Leonis	11	05	43.33	43.36	+ 0.03	"
	"	δ Hydræ	11	11	28.16	28.25	+ 0.09	"
1842, Jan.	2	☽'s 2d Limb	12	16	45.34			"
	"	q Virginis	12	25	38.91	38.71	— 0.20	"
	"	ψ Virginis	12	46	09.45	09.64	+ 0.19	"
	"	12 Can. Ven.	12	48	38.98	38.86	— 0.12	"
	"	α Virginis	13	16	53.22	53.42	+ 0.20	"
	"	x Virginis	13	41	18.36	18.25	— 0.11	"
	"	η Bootis	13	47	10.42	10.36	— 0.06	"
	"	α Bootis	14	08	27.85	27.92	+ 0.07	"
	4	x Virginis	13	14	18.64	18.28	— 0.36	"
	"	η Bootis	13	47	10.60	10.37	— 0.23	"
	"	☽'s 2d Limb	14	01	25.97			"
	"	α^2 Libræ	14	42	09.05	09.27	+ 0.22	"
	19	γ Pegasi	0	05	07.32	06.85	— 0.47	"
	"	η Piscium	1	23	03.60	03.23	— 0.37	"
	"	☽'s 1st Limb	1	43	53.37			"
	"	β Arietis	1	45	56.25	56.47	+ 0.22	"
	"	α Arietis	1	58	17.89	17.84	— 0.05	"
	"	ϑ^1 Arietis	2	09	22.17	22.20	+ 0.03	"
	"	δ Arietis	3	02	37.97	37.72	— 0.25	"
	"	η Tauri	3	38	08.25	08.11	— 0.14	"
	"	α Tauri	4	26	53.93	53.80	— 0.13	"
	20	η Piscium	1	23	03.56	03.21	— 0.35	"
	"	α Arietis	1	58	17.94	17.87	— 0.07	"

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		h. m. s.	s.	s.	
1842, Jan. 20	ϑ^1 Arietis	2 19 22.30	22.20	— 0.10	B
"	☽'s 1st Limb	2 37 05.59			"
"	ε Arietis	2 50 13.15	12.86	— 0.29	"
"	η Tauri	3 38 08.03	08.10	+ 0.07	"
22	☽'s 1st Limb	4 38 07.47			"
"	ι Tauri	4 53 41.42	41.68	+ 0.26	"
"	Capella	5 05 04.72	04.54	— 0.18	"
"	β Orionis	5 06 58.86	58.91	+ 0.05	"
"	β Tauri	5 16 20.81	21.04	+ 0.23	"
"	δ Orionis	5 23 58.44	58.40	— 0.04	"
"	ε Orionis	5 28 14.06	14.12	+ 0.06	"
"	α Columbæ	5 33 57.96	57.98	+ 0.02	"
"	α Orionis	5 46 39.58	39.52	— 0.06	"
"	H Geminorum	5 54 33.52	33.60	+ 0.08	"
"	μ^1 Geminorum	6 13 26.45	26.71	+ 0.26	"
"	Sirius	6 38 13.60	13.48	— 0.12	"
23	α Tauri	4 26 53.82	53.76	— 0.06	"
"	Capella	5 05 04.59	04.52	— 0.07	"
"	β Orionis	5 06 58.98	58.90	— 0.08	"
"	β Tauri	5 16 21.06	21.03	— 0.03	"
"	δ Orionis	5 23 58.25	58.39	+ 0.14	"
"	α Leporis	5 25 47.74	47.93	+ 0.19	"
"	ε Orionis	5 28 13.89	14.12	+ 0.23	"
"	α Columbæ	5 32 57.98	57.97	— 0.01	"
"	☽'s 1st Limb	5 44 45.47			"
"	H Geminorum	5 54 33.94	33.66	— 0.34	"
"	μ^1 Geminorum	6 13 26.97	26.71	— 0.26	"
"	Sirius	6 38 13.61	13.48	— 0.13	"
24	α Tauri	4 26 53.96	53.75	— 0.21	"
"	α Columbæ	5 33 57.71	57.95	+ 0.24	"
"	Capella	5 05 04.82	04.51	— 0.31	"
"	β Tauri	5 16 21.25	21.03	— 0.22	"
"	δ Orionis	5 23 58.19	58.39	+ 0.20	"
"	α Leporis	5 25 47.72	47.92	+ 0.20	"
"	ε Orionis	5 28 13.70	14.12	+ 0.40	"
"	α Orionis	5 46 39.44	39.52	+ 0.08	"
"	μ^1 Geminorum	6 13 26.92	26.71	— 0.21	"
"	Sirius	6 38 13.44	13.48	+ 0.04	"
"	☽'s 1st Limb	6 52 38.25			"
"	δ Geminorum	7 24 33.76	33.77	+ 0.01	"
"	Procyon	7 31 04.26	04.17	— 0.09	"
"	κ Geminorum	7 34 56.77	56.96	+ 0.19	"
25	α Tauri	4 26 53.80	53.75	— 0.05	"
"	Capella	5 05 04.44	04.50	+ 0.06	"
"	β Orionis	5 06 59.10	58.90	— 0.20	"
"	ε Orionis	5 28 14.05	14.10	+ 0.05	"
"	α Orionis	5 46 39.53	39.51	— 0.02	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1842, Jan. 25	μ Geminorum	6	13	26.71	26.71	0.00	B
"	Sirius	6	38	13.61	13.48	—0.13	"
"	δ Geminorum	7	10	43.78	43.80	+0.02	"
"	α^2 Geminorum	7	24	33.63	33.78	+0.15	"
"	Procyon	7	31	04.18	04.18	0.00	"
"	☽'s 1st Limb	7	59	05.01			"
"	ϑ Cancri	8	22	37.86	37.60	—0.26	"
"	δ Cancri	8	35	44.80	44.69	—0.11	"
"	ϵ Hydræ	8	38	26.82	26.99	+0.17	"
26	Capella	5	05	04.60	04.49	—0.11	"
"	β Tauri	5	16	20.96	21.01	+0.05	"
"	δ Orionis	5	23	58.37	58.37	0.00	"
"	α Leporis	5	25	47.91	47.90	—0.01	"
"	ϵ Orionis	5	28	14.09	14.10	+0.01	"
"	α Columbæ	5	33	58.00	57.92	—0.08	"
"	α Orionis	5	46	39.41	39.51	+0.10	"
"	δ Geminorum	7	10	43.70	43.80	+0.10	"
"	α^2 Geminorum	7	24	33.63	33.78	+0.15	"
"	Procyon	7	31	04.27	04.18	—0.09	"
"	$\varkappa$ Geminorum	7	34	57.12	56.92	—0.20	"
"	ϑ Cancri	8	22	37.38	37.61	+0.23	"
"	δ Cancri	8	35	44.34	44.70	+0.36	"
"	☽'s 2d Limb	9	04	43.40			"
27	Capella	5	05	04.39	04.47	+0.08	"
"	β Orionis	5	06	58.94	58.87	—0.07	"
"	β Tauri	5	16	21.27	21.00	—0.27	"
"	δ Orionis	5	23	58.40	58.36	—0.04	"
"	α Leporis	5	25	48.30	47.89	—0.41	"
"	ϵ Orionis	5	28	13.92	14.09	+0.17	"
"	α Columbæ	5	33	57.72	57.92	+0.20	"
"	α Orionis	5	46	39.21	39.50	+0.29	"
"	α^2 Geminorum	7	24	33.82	33.78	—0.04	"
"	Procyon	7	31	04.09	04.18	+0.09	"
"	$\varkappa$ Geminorum	7	34	56.85	56.90	+0.05	"
"	ϑ Cancri	8	22	37.68	37.62	—0.06	"
"	ξ Leonis	8	23	28.03	28.18	+0.15	"
"	o Leonis	9	34	45.33	45.50	+0.17	"
"	☽'s 2d Limb	10	04	12.42			"
"	γ Leonis	10	11	17.68	17.62	—0.06	"
"	ρ Leonis	10	24	31.63	31.71	+0.08	"
Feb. 1	λ Virginis	14	10	35.95	35.85	—0.10	"
"	☽'s 2d Limb	13	37	52.64			"
"	α^2 Libræ	14	42	09.95	10.21	+0.26	"
"	20 Libræ	14	54	51.58	51.78	+0.20	"
"	β Libræ	15	08	31.86	31.86	0.00	"
"	α Cor. Bor.	15	28	00.98	00.76	—0.22	"
19	γ^1 Eridani	3	50	40.92	40.88	—0.04	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1842, Feb. 19	υ^1 Tauri	4 16 53.53	52.97	— 0.56	B
"	τ Tauri	4 32 48.32	47.88	— 0.44	"
"	Capella	5 05 04.14	04.06	— 0.08	"
"	β Orionis	5 06 58.29	58.57	+ 0.28	"
"	☽'s 1st Limb	5 13 48.64			"
"	β Tauri	5 16 20.86	20.72	— 0.14	"
"	δ Orionis	5 23 58.26	58.11	— 0.15	"
"	α Leporis	5 25 47.62	47.58	— 0.04	"
"	ϵ Orionis	5 28 13.85	13.83	— 0.02	"
"	c Tauri	5 43 26.91	26.24	— 0.67	"
"	α Orionis	5 46 39.27	39.27	0.00	"
20	Capella	5 05 04.18	04.04	— 0.14	"
"	β Tauri	5 16 20.85	20.70	— 0.15	"
"	δ Orionis	5 23 57.94	58.09	+ 0.15	"
"	ϵ Orionis	5 28 13.87	13.81	— 0.06	"
"	μ^1 Geminorum	6 13 26.25	26.50	+ 0.25	"
"	☽'s 1st Limb	6 18 57.41			"
"	ϵ Geminorum	6 34 14.78	15.18	+ 0.40	"
"	Sirius	6 38 13.33	13.26	— 0.07	"
21	Capella	5 05 03.96	04.04	+ 0.08	"
"	Sirius	6 38 13.06	13.25	+ 0.19	"
"	ζ Geminorum	6 54 46.69	46.74	+ 0.05	"
"	δ Cancri	6 10 44.02	44.80	+ 0.78	"
"	☽'s 1st Limb	7 24 20.68			"
"	Procyon	7 31 04.25	04.12	— 0.13	"
"	β Geminorum	7 35 41.36	41.34	— 0.02	"
24	Capella	5 05 04.06	03.95	— 0.11	"
"	β Orionis	5 06 58.51	58.49	— 0.02	"
"	β Tauri	5 16 20.82	20.63	— 0.19	"
"	δ Orionis	5 23 58.02	58.03	+ 0.01	"
"	α Leporis	5 25 47.74	47.49	— 0.25	"
"	ϵ Orionis	5 28 13.55	13.75	+ 0.20	"
"	α Orionis	5 46 38.89	39.20	+ 0.31	"
"	δ Cancri	8 35 44.80	44.80	0.00	"
"	ϵ Hydræ	8 38 27.02	27.09	+ 0.07	"
"	α^2 Cancri	8 49 53.40	53.15	— 0.25	"
"	o Leonis	9 32 45.80	45.74	— 0.06	"
"	☽'s 1st Limb	10 27 37.28			"
"	☽'s 2d Limb	10 29 57.24			"
"	α Leonis	10 00 00.05	00.06	+ 0.01	"
25	15 Argus	8 00 51.30	51.35	+ 0.05	"
"	α Leonis	10 00 00.29	00.06	— 0.23	"
"	δ Leonis	11 05 44.76	44.75	— 0.01	"
"	☽'s 2d Limb	11 27 28.61			"
March 15	☽'s 1st Limb	2 01 40.67			"
"	Aldebaran	4 26 53.06	53.02	— 0.04	"
"	Capella	5 05 03.58	03.50	— 0.08	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1842, March 15	β Orionis	5	06	58.06	58.16	+ 0.10	B
"	β Tauri	5	16	20.49	20.28	— 0.21	"
"	δ Orionis	5	23	57.67	57.71	+ 0.04	"
"	ε Orionis	5	28	13.25	13.44	+ 0.19	"
16	☽'s 1st Limb	2	54	48.27			"
"	α Tauri	4	26	52.96	53.00	+ 0.04	"
"	Capella	5	05	03.64	03.47	— 0.17	"
"	β Orionis	5	06	58.18	58.14	— 0.04	"
"	β Tauri	5	16	20.71	20.26	— 0.45	"
"	δ Orionis	5	23	57.65	57.69	+ 0.04	"
"	α Leporis	5	25	46.89	47.11	+ 0.22	"
"	ε Orionis	5	28	13.67	13.42	— 0.25	"
18	α Tauri	4	26	52.90	52.96	+ 0.06	"
"	☽'s 1st Limb	4	51	56.67			"
"	Capella	5	05	03.53	03.43	— 0.10	"
"	β Orionis	5	06	57.84	58.10	+ 0.26	"
"	β Tauri	5	16	20.38	20.23	— 0.15	"
"	δ Orionis	5	23	57.59	57.66	+ 0.07	"
"	ε Orionis	5	28	13.40	13.38	— 0.02	"
"	α Orionis	5	46	38.87	38.84	— 0.03	"
19	☽'s 1st Limb	5	54	20.25			"
"	μ Geminorum	6	13	26.13	26.05	— 0.08	"
"	ε Geminorum	6	34	14.69	14.74	+ 0.05	"
"	Sirius	6	38	12.41	12.81	+ 0.40	"
"	α^2 Geminorum	7	24	33.77	33.32	— 0.45	"
"	Procyon	7	31	04.01	03.82	— 0.19	"
"	β Geminorum	7	35	41.06	40.99	— 0.07	"
"	15 Argus	7	00	51.16	51.15	— 0.01	"
20	☽'s 1st Limb	6	57	39.65			"
"	δ Geminorum	7	10	42.27	43.32	+ 0.95	"
"	α^2 Geminorum	7	24	33.32	33.29	— 0.03	"
"	Procyon	7	31	03.85	03.77	— 0.08	"
"	β Geminorum	7	35	40.85	40.96	+ 0.11	"
23	ε Hydræ	8	38	26.81	26.87	+ 0.06	"
"	ι Urs. Maj.	4	48	25.27	25.13	— 0.14	"
"	α Hydræ	9	19	52.08	51.90	— 0.18	"
"	ξ Leonis	9	23	28.48	28.26	— 0.22	"
"	ο Leonis	9	32	45.84	45.62	— 0.22	"
"	ε Leonis	9	36	55.39	55.36	— 0.03	"
"	☽'s 1st Limb	9	58	00.34			"
"	α Leonis	9	59	59.79	60.01	+ 0.22	"
"	ρ Leonis	10	24	32.29	32.11	— 0.18	"
April 16	☽'s 1st Limb	6	38	01.04			"
"	δ Cancri	8	35	44.47	44.20	— 0.27	"
"	α^2 Cancri	8	49	52.62	52.62	0.00	"
"	ε Hydræ	8	38	26.25	26.53	+ 0.28	"
"	α Leonis	9	59	59.79	59.79	0.00	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1842, April 20	α^2 Geminorum	7	24	32.42	32.73	+ 0.31	B^2*
"	Procyon	7	31	02.98	03.28	+ 0.30	"
"	β Geminorum	7	35	40.35	40.43	+ 0.08	"
"	ε Hydræ	8	38	26.28	26.46	+ 0.18	"
"	π Leonis	9	51	54.22	54.14	— 0.08	B
"	α Leonis	9	59	59.99	59.74	— 0.25	B^2
"	☽'s 1st Limb	10	30	28.45			B
"	δ Leonis	11	05	45.25	44.74	— 0.51	"
21	α Hydræ	9	19	51.58	51.54	— 0.04	"
"	*d* Leonis	10	52	26.72	26.67	— 0.05	"
"	δ Leonis	11	05	44.82	44.73	— 0.09	"
"	δ Hydræ	11	11	29.24	29.52	+ 0.28	"
"	☽'s 1st Limb	11	24	43.92			"
"	υ Leonis	11	28	54.35	54.39	+ 0.04	"
"	β Virginis	11	24	30.79	31.00	+ 0.21	"
"	γ Urs. Maj.	11	45	33.52	33.47	— 0.05	"
22	*d* Leonis	10	52	26.54	26.67	+ 0.13	"
"	δ Leonis	11	05	44.69	44.72	+ 0.03	"
"	δ Hydræ	11	11	29.53	29.51	— 0.02	"
"	υ Leonis	11	28	54.13	54.38	+ 0.25	"
"	β Virginis	11	42	30.69	30.99	+ 0.30	"
"	☽'s 1st Limb	12	19	14.73			"
"	*q* Virginis	12	25	41.04	40.61	— 0.43	"
"	ψ Virginis	12	46	11.69	11.71	+ 0.02	"
"	γ Urs. Maj.	11	45	34.09	33.45	— 0.64	"
23	Procyon	7	31	03.14	03.24	+ 0.10	"
"	β Geminorum	7	35	40.30	40.38	+ 0.08	"
"	β Virginis	11	42	30.71	30.98	+ 0.27	"
"	γ Urs. Maj.	11	45	33.12	33.44	+ 0.32	"
"	ψ Virginis	12	46	11.46	11.71	+ 0.25	"
"	12 Can. Ven.	12	48	41.14	41.20	+ 0.06	"
"	☽'s 1st Limb	13	15	59.36			"
"	α Virginis	13	16	55.78	55.72	— 0.06	"
27	α Herculis	17	07	29.29	29.43	+ 0.14	"
"	☽'s 1st Limb	17	15	58.00			"
"	e^2 Ophiuchi	17	21	50.22	50.03	— 0.19	"
"	4 Sagittarii	17	50	12.06	11.94	— 0.12	"
"	μ^1 Sagittarii	18	04	22.03	21.92	— 0.11	"
29	☽'s 2d Limb	19	10	36.92			"
"	p^1 Sagittarii	19	12	33.48	33.19	— 0.29	"
"	δ Aquilæ	19	17	34.21	34.14	— 0.07	"
"	α Aquilæ	19	43	06.57	06.56	— 0.01	"
30	α Aquilæ	19	43	06.58	06.57	— 0.01	"
"	β Aquilæ	19	47	35.21	35.26	+ 0.05	"
"	☽'s 2d Limb	20	03	02.73			"
May 5	☽'s 1st Limb	23	08	05.12			B^2
"	Sirius	6	38	11.92	12.04	+ 0.12	"

* B^2 indicates the observation to have been made by G. P. Bond.

Date.	Name of Object.	Sidereal Time of Meridian Passage. h. m. s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1842, May 5	ε Leonis	9 36 54.96	54.79	— 0.17	B²
14	☽'s 1st Limb	7 20 57.89			B
"	α^2 Geminorum	7 24 32.26	32.38	+ 0.12	"
"	Procyon	7 31 03.01	03.00	— 0.01	"
"	β Geminorum	7 35 40.18	40.09	— 0.09	"
"	α Hydræ	9 19 51.25	51.23	— 0.02	"
"	δ Leonis	11 05 44.72	44.48	— 0.24	"
"	β Leonis	11 41 02.35	02.58	+ 0.23	"
16	Procyon	7 31 02.91	02.99	+ 0.08	"
"	☽'s 1st Limb	9 17 50.12			"
"	ε Leonis	9 36 54.75	54.64	— 0.11	"
"	α Leonis	9 59 59.48	59.42	— 0.06	"
"	β Leonis	11 41 02.63	02.56	— 0.07	"
"	γ Urs. Maj.	11 45 32.88	32.98	+ 0.10	"
"	β Corvi	12 26 08.82	08.83	+ 0.01	"
"	12 Can. Ven.	12 48 40.99	41.00	+ 0.01	"
"	Spica	13 16 55.66	55.73	+ 0.07	"
18	α Leonis	9 59 59.46	59.76	+ 0.30	"
"	☽'s 1st Limb	11 05 53.15			"
"	β Leonis	11 41 02.64	02.53	— 0.11	"
"	γ Urs. Maj.	11 45 33.23	32.91	— 0.32	"
"	12 Can. Ven.	12 48 40.86	41.02	+ 0.16	"
20	η Virginis	12 11 52.27	52.12	— 0.15	"
"	q Virginis	12 25 40.38	40.50	+ 0.12	"
"	12 Can. Ven.	12 48 40.97	40.97	0.00	"
"	☽'s 1st Limb	12 52 30.39			"
"	53 Virginis	13 03 42.53	42.56	+ 0.03	"
21	α Virginis	13 16 55.72	55.72	0.00	"
"	☽'s 1st Limb	13 48 01.80			"
23	α Leonis	9 59 59.38	59.34	— 0.04	"
"	β Corvi	12 26 08.98	08.82	— 0.16	"
"	12 Can. Ven.	12 48 40.90	40.94	+ 0.04	"
"	α Virginis	13 16 55.79	55.71	— 0.08	"
"	η Bootis	13 46 12.52	12.87	+ 0.35	"
"	α Bootis	14 08 30.54	30.59	+ 0.05	"
"	λ Virginis	14 10 37.57	37.73	+ 0.16	"
"	ε Bootis	14 38 08.57	08.49	— 0.08	"
"	α^2 Libræ	14 42 12.36	12.40	+ 0.04	"
"	20 Libræ	14 54 53.91	54.22	+ 0.31	"
"	ι^1 Libræ	15 03 17.33	17.24	— 0.09	"
"	β Libræ	15 08 34.29	34.17	— 0.12	"
"	☽'s 2d Limb	15 47 57.78			"
"	β^1 Scorpii	15 56 19.41	19.21	— 0.20	"
"	α Scorpii	16 19 47.77	47.69	— 0.08	"
25	A¹ Ophiuchi	17 05 41.89	42.37	+ 0.48	"
"	ϑ Ophiuchi	17 12 22.48	22.58	+ 0.10	"
"	α Ophiuchi	17 27 39.35	39.15	— 0.20	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1842, May 25	☽'s 2d Limb	17	48	40.36			B
"	μ^1 Sagittarii	18	04	22.46	22.68	+0.22	"
"	λ Sagittarii	18	18	17.13	17.09	−0.04	"
"	α Lyræ	18	31	38.34	38.15	−0.19	"
"	β Lyræ	18	44	17.56	17.67	+0.11	"
30	δ Aquilæ	19	17	34.93	35.01	+0.08	B[2]
"	β Aquilæ	19	47	36.03	36.14	+0.11	"
"	α^2 Capricorni	20	09	20.01	20.23	+0.22	"
"	☽'s 2d Limb	22	05	20.09			B
June 20	β Libræ	15	08	34.27	34.24	−0.03	"
"	b Scorpii	15	41	33.32	33.27	−0.05	"
"	ζ Urs. Min.	15	49	54.73	54.72	−0.01	"
"	δ Ophiuchi	16	07	08.10	07.96	−0.14	"
"	Antares	16	19	47.87	48.02	+0.15	"
"	☽'s 1st Limb	16	23	40.12			"
"	η Ophiuchi	17	01	23.81	23.34	−0.47	"
21	δ Ophiuchi	16	06	07.97	07.96	−0.01	"
"	Antares	16	19	47.70	48.02	+0.32	"
"	η Ophiuchi	17	01	23.40	23.35	−0.05	"
"	α Herculis	17	07	30.28	30.28	0.00	"
"	☽'s 1st Limb	17	22	25.55			"
"	α Ophiuchi	17	27	39.63	39.67	+0.04	"
"	3 Sagittarii	17	37	41.58	41.50	−0.08	"
"	4 Sagittarii	17	50	13.47	13.14	−0.33	"
"	μ^1 Sagittarii	18	04	23.13	23.16	+0.03	"
29	☽'s 2d Limb	0	00	01.90			"
"	α Cassiopeæ	0	31	37.26	37.11	−0.15	"
"	β Ceti	0	35	41.64	41.79	+0.15	"
July 11	α Leonis	9	59	59.08	58.98	−0.10	"
"	☽'s 1st Limb	10	30	44.42			"
"	η Urs. Maj.	13	41	21.23	20.89	−0.34	"
"	η Bootis	13	47	12.46	12.47	+0.01	"
"	α Bootis	14	08	30.36	30.22	−0.14	"
"	ε Bootis	14	38	08.14	08.15	+0.01	"
"	α^2 Libræ	14	42	12.24	12.26	+0.02	"
"	β Urs. Min.	14	51	16.54	16.88	+0.34	"
"	β Libræ	15	08	33.84	34.14	+0.30	"
14	☽'s 1st Limb	13	12	47.60			"
"	Spica	13	16	55.31	55.33	+0.02	"
"	Arcturus	14	08	30.16	30.18	+0.02	"
"	ε Bootis	14	38	07.92	08.09	+0.17	"
"	β Urs. Min.	14	51	16.88	16.66	−0.22	"
"	β Libræ	15	08	34.34	34.10	−0.24	"
16	β Libræ	15	08	34.10	34.10	0.00	"
"	☽'s 1st Limb	15	05	02.92			"
18	α^2 Libræ	14	42	12.28	12.19	−0.09	"
"	ε Bootis	14	38	08.56	08.39	−0.17	"

Date.		Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
			h.	m.	s.	s.	s.	
1842, July	18	β Urs. Min.	14	51	16.18	16.28	+ 0.10	B
	"	α Serpentis	15	36	32.94	32.59	— 0.35	"
	"	σ Scorpii	16	11	40.05	39.83	— 0.22	"
	"	Antares	16	19	47.61	47.98	+ 0.37	"
	"	☽'s 1st Limb	17	02	30.19			"
	"	ϑ Ophiuchi	17	12	23.09	23.04	— 0.05	"
	"	e^2 Ophiuchi	17	21	50.94	51.20	+ 0.26	"
	19	β Libræ	15	08	34.18	34.07	— 0.11	"
	"	Antares	16	19	47.74	47.98	+ 0.24	"
	"	ϑ Ophiuchi	17	12	23.31	23.04	— 0.27	"
	"	α Ophiuchi	17	27	40.01	39.72	— 0.29	"
	"	☽'s 1st Limb	18	00	45.27			"
	"	μ^1 Sagittarii	18	04	23.35	23.38	+ 0.03	"
	20	α Lyræ	18	31	38.36	38.71	+ 0.35	"
	"	☽'s 1st Limb	18	56	57.48			"
	"	δ Aquilæ	19	17	36.16	35.81	— 0.35	"
	"	h^2 Sagittarii	19	27	10.18	10.05	— 0.13	"
August	2	α Tauri	4	26	54.42	54.18	— 0.24	"
	"	☽'s 2d Limb	4	54	11.77			"
	"	Capella	5	05	04.43	04.48	+ 0.05	"
	"	β Orionis	5	06	58.55	58.71	+ 0.16	"
	17	Antares	16	19	47.50	47.65	+ 0.15	"
	"	η Draconis	16	22	53.30	53.25	— 0.05	"
	"	ζ Aquilæ	18	58	12.78	12.61	— 0.17	"
	"	☽'s 1st Limb	19	33	19.84			"
	"	β Aquilæ	19	47	37.08	37.10	+ 0.02	"
	"	α^2 Capricorni	20	09	21.42	21.46	+ 0.04	"
	19	β Lyræ	18	44	17.95	18.12	+ 0.17	"
	"	α Aquilæ	19	43	08.24	08.39	+ 0.15	"
	"	β Aquilæ	19	47	37.27	37.12	— 0.15	"
	"	α^2 Capricorni	20	09	21.28	21.46	+ 0.18	"
	"	ϑ Capricorni	20	57	08.52	08.43	— 0.09	"
	"	61 Cygni	20	59	53.39	53.24	— 0.15	"
	"	s Capricorni	21	07	04.84	04.82	— 0.02	"
	"	☽'s 1st Limb	21	12	24.13			"
	"	β Aquarii	21	23	18.85	18.64	— 0.21	"

Mr. Bond communicated a third series of moon culminations, made at Dorchester.

Mr. Bond remarked, that, although these observations had been made at Dorchester, yet the results might safely be reduced to the new Observatory in Cambridge, by means of the differences of latitude and longitude given with each series, without risk of sensible error; the points of observation

were within a small compass, and the differences had been accurately determined by triangulation.

Moon Culminations,

Observed at Dorchester with a Portable Transit Instrument of 22 inches Focus; corrected for Collimation, Level, and Azimuthal Deviation, and for Clock Error and Rate on Sidereal Time.

Lat. +42° 19′ 17″. Lon. West of Greenwich, 4 h. 44 m. 17 s.

Date.	Name of Object.	Sidereal Time of Meridian Passage. h. m. s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1838, Aug. 26	α Bootis	14 08 17.61	17.77	+ 0.16	B
"	☽'s 1st Limb	14 50 36.03			"
"	α Ophiuchi	17 27 27.43	27.26	— 0.17	"
28	α Scorpii	16 19 31.59	31.57	— 0.02	"
"	☽'s 1st Limb	16 37 49.01			"
"	α Herculis	17 07 17.64	17.93	+ 0.29	"
"	α Ophiuchi	17 27 27.61	27.36	— 0.25	"
"	γ Draconis	17 52 52.69	52.67	— 0.02	"
29	α Herculis	17 07 18.16	17.92	— 0.24	"
"	α Ophiuchi	17 27 26.98	27.22	+ 0.24	"
"	☽'s 1st Limb	17 38 26.06			"
30	α Ophiuchi	17 27 27.08	27.21	+ 0.13	"
"	α Lyræ	18 31 29.40	29.28	— 0.12	"
"	☽'s 1st Limb	18 42 06.73			"
"	σ Sagittarii	18 45 16.15	16.41	+ 0.26	"
"	τ Sagittarii	18 56 53.24	52.85	— 0.39	"
31	γ Draconis	17 52 52.50	52.58	+ 0.08	"
"	μ^1 Sagittarii	18 04 07.54	07.62	+ 0.08	"
"	α Lyræ	18 31 29.43	29.25	— 0.18	"
"	σ Sagittarii	18 45 16.37	16.39	+ 0.02	"
"	☽'s 1st Limb	19 46 44.04			"
"	c Sagittarii	19 52 45.04	45.00	— 0.04	"
Sept. 2	α Ophiuchi	17 27 27.31	27.15	— 0.16	"
"	γ Draconis	17 52 52.73	52.52	— 0.21	"
"	ε Pegasi	21 36 16.90	16.90	0.00	"
"	☽'s 1st Limb	21 51 02.08			"
"	ι Aquarii	21 57 43.96	44.47	+ 0.51	"
"	σ Aquarii	22 22 07.24	07.71	+ 0.47	"
3	ι Aquarii	21 57 44.68	44.47	— 0.21	"
"	σ Aquarii	22 22 07.30	07.71	+ 0.41	"
"	☽'s 1st Limb	22 49 09.46			"
"	☽'s 2d Limb	22 51 48.59			"
"	φ Aquarii	23 05 58.82	59.33	+ 0.51	"
4	δ Aquilæ	19 17 22.95	22.44	— 0.51	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1838, Sept. 4	γ Aquilæ	19	38	36.54	36.23	— 0.31	B
"	α Aquilæ	19	42	55.67	55.55	— 0.12	"
"	β Aquilæ	19	47	24.18	24.21	+ 0.03	"
"	α^2 Capricorni	20	09	06.66	06.97	+ 0.31	"
"	α Cygni	20	35	57.04	57.16	+ 0.12	"
"	61′ Cygni	20	59	41.38	41.78	+ 0 40	"
"	ζ Cygni	21	06	05.83	05.47	— 0.36	"
"	ζ Pegasi	22	33	26.39	26 17	— 0.22	"
"	Fomalhaut	22	48	45.04	45.03	— 0.01	"
"	α Pegasi	22	56	45.39	44.87	— 0.52	"
"	φ Aquarii	23	05	59.47	59.33	— 0.14	"
"	$\varkappa^1$ Piscium	23	18	40.83	41.07	+ 0.24	"
"	☽'s 2d Limb	23	47	32.19			"
"	ι Piscium	0	17	09.00	08.77	— 0.23	"
5	ε Piscium	0	54	35.94	35.66	— 0.28	"
"	☽'s 2d Limb	0	42	42.02			"
"	ϑ Ceti	1	15	58.78	58.86	+ 0.08	"
6	☽'s 2d Limb	1	38	17.28			"
"	γ^1 Arietis	1	44	42.39	42.09	— 0.30	"
"	α Arietis	1	58	06.33	06.19	— 0.14	"
"	ϑ Arietis	2	09	10.70	10.59	— 0.11	"
"	γ Ceti	2	34	58.21	58.33	+ 0.12	"
"	Capella	5	04	46.53	46.53	0.00	"
8	β Lyræ	18	44	08.69	08.13	— 0.56	"
"	δ Aquilæ	19	17	21.93	22.40	+ 0.47	"
"	γ Aquilæ	19	38	36.49	36.19	— 0.30	"
"	α Aquilæ	19	42	55.16	55.51	+ 0.35	"
"	β Aquilæ	19	47	24.17	24.18	+ 0.01	"
"	☽'s 2d Limb	3	34	54.20			"
9	α Tauri	4	26	40.27	40.35	+ 0.08	"
"	☽'s 2d Limb	4	35	39.05			"
"	β Tauri	5	16	05.89	05.80	— 0.09	"
10	γ^1 Eridani	3	50	30.71	30.81	+ 0.10	"
"	α Tauri	4	26	40.31	40.38	+ 0.07	"
"	Capella	5	04	47.07	46.69	— 0.38	"
"	β Tauri	5	16	05.63	05.82	+ 0.19	"
"	☽'s 2d Limb	5	37	32.17			"
"	α Orionis	5	46	26.10	26.09	— 0.01	"
13	β Tauri	5	16	06.20	05.92	— 0.28	"
"	δ Orionis	5	23	46.14	46.12	— 0.02	"
"	ε Orionis	5	28	01.56	01.81	+ 0.25	"
"	Sirius	6	38	01.78	01.81	+ 0.03	W
"	☽'s 2d Limb	8	31	37.57			B
30	η Capricorni	20	55	14.12	14.11	— 0.01	"
"	ζ Cygni	21	06	05.19	05 19	0.00	"
"	γ Capricorni	21	31	10.12	09.93	— 0.19	"
"	δ Capricorni	21	38	09.32	08.92	— 0.40	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1838, Sept. 30	σ Aquarii	22	22	07.95	07.70	— 0.25	B
"	☽'s 1st Limb	22	18	53.85			"
"	ε Canis Maj.	6	52	17.16	17.16	0.00	"
Oct. 1	γ Aquilæ	19	38	36.79	35.86	— 0.93	"
"	α Aquilæ	19	42	54.87	55.20	+ 0.33	"
"	β Aquilæ	19	47	23.87	23.87	0.00	"
"	γ Capricorni	21	31	09.33	09.93	+ 0.60	"
"	δ Capricorni	21	38	08.73	08.92	+ 0.19	"
"	σ Aquarii	22	22	07.17	07.70	+ 0.53	"
"	☽'s 1st Limb	23	15	14.53			"
"	κ¹ Piscium	23	18	40.83	41.20	+ 0.37	"
"	n Piscium	23	39	40.50	39.85	— 0.65	"
"	Procyon	7	30	51.74	51.24	— 0.50	"
2	γ Capricorni	21	31	10.05	09.89	— 0.16	"
"	δ Capricorni	21	38	08.67	08.90	+ 0.23	"
"	ζ Pegasi	22	33	25.80	26.17	+ 0.37	"
"	☽'s 1st Limb	0	10	47.02			"
"	☽'s 2d Limb	0	13	06.62			"
"	ι Piscium	0	17	10.17	09.09	— 1.08	"
3	δ Aquilæ	19	17	22.54	22.03	— 0.51	"
"	γ Aquilæ	19	38	35.92	35.82	— 0.10	"
"	α Aquilæ	19	42	54.46	55.00	+ 0.54	"
"	β Aquilæ	19	47	23.45	23.83	+ 0.38	"
"	α Pegasi	22	56	45.50	44.89	— 0.61	"
"	φ Aquarii	23	05	59.39	59.39	0.00	"
"	β Ceti	0	35	30.91	31.06	+ 0.15	"
"	☽'s 2d Limb	1	09	06.56			"
4	η Piscium	1	22	53.45	52.97	— 0.48	"
"	ο Piscium	1	36	54.25	54.16	— 0.09	"
"	☽'s 2d Limb	2	06	44.59			"
"	ψ Arietis	2	21	59.44	59.05	— 0.39	"
"	π Arietis	2	40	18.48	19.31	+ 0.83	"
5	π Arietis	2	40	19.63	19.33	— 0.30	"
"	☽'s 2d Limb	3	06	50.67			"
"	g Arietis	3	14	49.17	48.64	— 0.53	"
"	η Tauri	3	37	55.54	55.40	— 0.14	"
"	γ¹ Eridani	3	50	31.48	31.49	+ 0.01	"
"	α Tauri	4	26	40.95	41.13	+ 0.18	"
"	β Orionis	5	06	47.65	48.03	+ 0.38	"
"	β Tauri	5	16	06.97	06.67	— 0.30	"
7	☽'s 2d Limb	5	13	13.66			"
"	β Tauri	5	16	06.99	06.74	— 0.25	"
"	C Tauri	5	43	11.91	12.06	+ 0.15	"
"	α Orionis	5	46	26.72	27.01	+ 0.29	"
"	μ Geminorum	6	13	12.02	12.53	+ 0.51	"
"	ε Geminorum	6	34	00.79	00.75	— 0.04	"
"	Sirius	6	38	02.88	02.52	— 0 36	"

Date.	Name of Object.	Sidereal Time of Meridian Passage. h.	m.	s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1838, Oct. 7	α^2 Geminorum	7	24	18.54	18.18	— 0.36	B
"	Procyon	7	30	51.35	51.42	+ 0.07	"
"	β Geminorum	7	35	26.24	26.35	+ 0.11	"
8	C Tauri	5	43	12.12	12.10	— 0.02	"
"	α Orionis	5	46	26.65	27.04	+ 0.39	"
"	μ Geminorum	6	13	12.61	12.56	— 0.05	"
"	☽'s 2d Limb	6	16	32.00			"
"	ε Geminorum	6	34	00.41	00.78	+ 0.37	"
"	Sirius	6	38	02.79	02.55	— 0.24	"
11	δ Geminorum	7	10	29.87	29.44	— 0.43	"
"	α^2 Geminorum	7	24	18.07	18.33	+ 0.26	"
"	Procyon	7	30	51.84	51.54	— 0.30	"
"	β Geminorum	7	35	26.54	26.48	— 0.06	"
"	☽'s 2d Limb	9	06	27.75			"
25	γ Aquilæ	19	38	35.60	35.44	— 0.16	"
"	α Aquilæ	19	42	55.23	54.81	— 0.42	"
"	β Aquilæ	19	47	23.11	23.48	+ 0.37	"
"	☽'s 1st Limb	19	57	26.14			"
"	Fomalhaut	22	48	44.77	44.88	+ 0.11	"
26	ψ Capricorni	20	36	32.66	32.85	+ 0.19	"
"	☽'s 1st Limb	20	56	28.63			"
"	ζ Capricorni	21	17	27.68	27.67	— 0.01	"
"	β Aquarii	21	23	04.37	04.44	+ 0.07	"
"	γ Capricorni	21	31	09.48	09.60	+ 0.12	"
"	ε Pegasi	21	36	16.55	16.47	— 0.08	"
27	ζ Capricorni	21	17	27.59	27.64	+ 0.05	"
"	γ Capricorni	21	31	09.46	09.59	+ 0.13	"
"	☽'s 1st Limb	21	53	23.41			"
"	ι Aquarii	21	57	43.77	44.12	+ 0.35	"
"	σ Aquarii	22	22	07.14	07.47	+ 0.33	"
29	Fomalhaut	22	48	45.01	44.84	— 0.17	"
"	φ Aquarii	23	05	59.06	59.28	+ 0.22	"
"	☽'s 1st Limb	23	42	28.65			"
"	q Piscium	23	53	34.46	34.93	+ 0.47	"
"	t Piscium	0	17	09.42	09.08	— 0.34	"
31	ι Piscium	23	31	40.61	40.40	— 0.21	"
"	γ Pegasi	0	04	57.65	57.47	— 0.18	"
"	β Ceti	0	35	30.91	31.08	+ 0.17	"
"	Piscium	0	39	57.32			"
"	ε Piscium	0	54	36.61	36.16	— 0.45	"
"	☽'s 1st Limb	1	32	58.40			"
"	γ Arietis	1	44	43.67	42.87	— 0.80	"
Nov. 9	ε Leonis	9	36	41.44	41.68	+ 0.24	"
"	α Leonis	9	59	47.26	47.02	— 0.24	"
"	☽'s 2d Limb	10	24	28.43			"
10	ζ Cygni	21	06	04.54	04.48	— 0.06	"
"	β Aquarii	21	23	04.08	04.26	+ 0.18	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1838, Nov. 10	ε Pegasi	21	36	16.32	16.26	— 0.06	B
"	α Aquarii	21	57	30.44	30.51	+ 0.07	"
"	Fomalhaut	22	48	44.77	44.68	— 0.09	"
"	α Leonis	9	59	46.74	46.74	0.00	"
"	☽'s 2d Limb	11	08	48.46			"
11	α Leonis	9	59	46.84	46.74	— 0.10	W
"	☽'s 2d Limb	11	51	43.85			"
13	☽'s 2d Limb	14	18	00.30			"
"	Arcturus	14	08	17.69	17.69	0.00	B
19	☽'s 1st Limb	17	37	21.23			"
"	α Lyræ	18	31	28.09	27.49	— 0.60	"
"	α Cygni	20	35	54.94	55.52	+ 0.58	"
23	α Lyræ	18	31	27.38	27.44	+ 0.06	"
"	61′ Cygni	20	59	40.61	40.41	— 0.20	"
"	ε Capricorni	21	06	49.20	49.20	0.00	"
"	β Cephei	21	26	31.24	31.25	+ 0.01	"
"	☽'s 1st Limb	21	34	34.18			"
"	δ Capricorni	21	38	08.60	08.23	— 0.37	"
"	ι Aquarii	21	57	43.89	43.77	— 0.12	"
24	ι Aquarii	21	57	43.71	43.76	+ 0.05	"
"	☽'s 1st Limb	22	28	33.05			"
"	ζ Pegasi	22	33	25.66	25.63	— 0.03	"
"	λ Aquarii	22	44	12.48	12.60	+ 0.12	"
"	Fomalhaut	22	48	44.25	44.47	+ 0.22	"
"	α Pegasi	22	56	44.33	44.18	— 0.15	"
25	Fomalhaut	22	48	44.20	44.46	+ 0.26	"
"	α Pegasi	22	56	44.66	44.46	— 0.20	"
"	☽'s 1st Limb	23	20	59.91			"
"	ι Piscium	23	31	40.28	40.18	— 0.10	"
"	n Piscium	23	39	39.60	39.57	— 0.03	"
"	α Andromedæ	0	00	04.81	04.58	— 0.23	"
"	γ Pegasi	0	04	57.00	57.31	+ 0.31	"
26	Fomalhaut	22	48	44.26	44.44	+ 0.18	"
"	α Pegasi	22	56	44.59	44.45	— 0.14	"
"	ι Piscium	23	31	40.55	40.17	— 0.38	"
"	n Piscium	23	39	39.85	39.56	— 0.29	"
"	q Piscium	23	53	34.71	34.72	+ 0.01	"
"	α Andromedæ	0	00	04.49	04.57	+ 0.08	"
"	γ Pegasi	0	04	57.24	57.30	+ 0.06	"
"	☽'s 1st Limb	0	13	11.18			"
"	t Piscium	0	17	09.19	08.93	— 0.26	"
28	η Piscium	1	22	52.90	53.16	+ 0.26	"
"	o Piscium	1	36	54.42	54.41	— 0.01	"
"	α Arietis	1	58	07.40	07.13	— 0.27	"
"	☽'s 1st Limb	2	02	20.89			"
"	ψ Arietis	2	22	00.11	59.56	— 0.55	"
"	ν Arietis	2	29	41.87	41.53	— 0.34	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1838, Nov. 28	γ Ceti	2	34	58.60	58.86	+ 0.26	B
29	η Piscium	1	22	52.94	53.16	+ 0.22	"
"	α Arietis	1	58	07.04	07.13	+ 0.09	"
"	ψ Arietis	2	21	59.53	59.56	+ 0.03	"
"	ν Arietis	2	29	41.52	41.53	+ 0.01	"
"	γ Ceti	2	34	58.69	58.86	+ 0.17	"
"	☽'s 1st Limb	3	01	46.89			"
"	η Tauri	3	37	56.63	56.36	— 0.27	"
30	ν Arietis	2	29	41.21	41.55	+ 0.34	"
"	γ Ceti	2	34	58.51	58.86	+ 0.35	"
"	α Ceti	2	53	53.14	53.03	— 0.11	"
"	ζ Arietis	3	05	40.23	40.40	+ 0.17	"
"	η Tauri	3	37	56.49	56.37	— 0.12	"
"	γ^1 Eridani	3	50	32.47	32.35	— 0.12	"
"	☽'s 1st Limb	4	05	01.58			"
"	☽'s 2d Limb	4	07	32.80			"
"	υ^1 Tauri	4	16	41.80	41.54	— 0.26	"
"	τ Tauri	4	32	36.60	36.30	— 0.30	"
Dec. 2	β Tauri	5	16	08.45	08.25	— 0.20	"
"	α Orionis	5	46	28.20	28.45	+ 0.25	"
"	μ Geminorum	6	13	14.42	14.21	— 0.21	"
"	☽'s 2d Limb	6	19	34.60			"
"	Sirius	6	38	03.90	04.08	+ 0.18	"
3	ω^1 Geminorum	6	52	37.33	36.66	— 0.67	"
"	δ Geminorum	7	10	31.20	31.15	— 0.05	"
"	☽'s 2d Limb	7	23	03.30			"
"	β Geminorum	7	35	28.30	28.35	+ 0.05	"
"	φ Geminorum	7	43	39.13	39.13	0.00	"
"	15 Argus	8	00	42.10	42.09	— 0.01	"
5	☽'s 2d Limb	9	15	48.41			"
"	ψ Leonis	9	34	57.90	57.57	— 0.33	"
"	α Hydræ	9	19	41.01	40.84	— 0.17	"
"	α Leonis	9	59	47.73	47.90	+ 0.17	"
8	☽'s 2d Limb	11	34	38.18			"
"	β Leonis	11	40	50.42	50.42	0.00	"
"	b Virginis	11	51	41.38	41.57	+ 0.19	"
"	γ^1 Virginis	12	33	29.30	29.50	+ 0.20	"
9	Markab	22	56	44.68	44.31	— 0.37	"
"	β Virginis	11	42	18.39	18.38	— 0.01	"
"	b Virginis	11	51	41.70	41.60	— 0.10	"
"	☽'s 2d Limb	12	17	24.23			"
"	β Corvi	12	25	55.46	55.66	+ 0.20	"
"	γ^1 Virginis	12	33	29.67	29.53	— 0.14	"
"	12 Can. Ven.	12	48	28.81	29.03	+ 0.22	"
10	☽'s 2d Limb	13	00	30.24			"
"	Spica	13	16	42.22	42.22	0.00	"
"	Arcturus	14	08	18.58	18.24	— 0.34	"

Moon Culminations,

Observed at Dorchester with a Transit Instrument made by Troughton & Simms, having an Object-glass of two and three quarters inches Diameter, and forty-six inches Focus; corrected for Collimation, Level, and Azimuthal Deviation of the Transit Instrument, and for Clock Error and Rate on Sidereal Time.

Lat. +42° 19′ 17″. Lon. West of Greenwich, 4 h. 44 m. 17 s.

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1838, Dec. 11	Spica	13 16 42.25	42.25	0.00	B
"	☽'s 2d Limb	13 45 08.77			"
23	☽'s 1st Limb	23 56 12.31			"
"	γ Pegasi	0 04 57.05	57.05	0.00	"
25	☽'s 1st Limb	1 40 57.33			"
"	α Arietis	1 58 06.92	07.00	+0.08	"
"	ϑ¹ Arietis	2 09 11.60	11.51	—0.09	"
"	γ Ceti	2 34 58.83	58.81	—0.02	"
"	α Ceti	2 53 53.08	53.03	—0.05	"
26	α Andromedæ	0 00 04.20	04.20	0.00	"
"	γ Pegasi	0 04 57.34	56.99	—0.35	"
"	ϑ¹ Ceti	1 15 59.26	59.22	—0.04	"
"	γ¹ Arietis	1 44 43.10	42.75	—0.35	"
"	α Arietis	1 58 06.58	06.99	+0.41	"
"	ϑ Arietis	2 09 11.42	11.50	+0.08	"
"	☽'s 1st Limb	2 37 08.50			"
"	δ Arietis	3 02 27.01	26.70	—0.31	"
27	☽'s 1st Limb	3 37 05.04			"
"	α Serpentis	15 36 19.55	19.51	—0.04	"
"	η Bootis	13 47 00 57	00.94	+0.37	"
"	α Bootis	14 08 18.91	18.76	—0.15	"
"	ε Bootis	14 37 56.84	56.75	—0.09	"
"	α Cor. Bor.	15 27 51.46	51.41	—0.05	"
29	α Tauri	4 26 42.38	42.50	+0.12	"
"	ι Tauri	4 53 29.99	29.94	—0.05	"
"	Capella	5 04 50.33	49.96	—0.37	"
"	β Tauri	5 16 08.90	08.59	—0.31	"
"	δ Orionis	5 23 48.18	48.43	+0.25	"
"	ε Orionis	5 28 03.98	04.14	+0.16	"
"	α Leporis	5 25 39.15	39.34	+0.19	"
"	☽'s 1st Limb	5 45 50.27			"
"	C Tauri	5 43 14.37	14.10	—0.27	"
"	μ Geminorum	6 13 14.72	14.68	—0.04	"
30	Sirius	6 38 04.32	04.52	+0.20	"
"	☽'s 1st Limb	6 50 27.78			"
"	ε Geminorum	7 00 55.42	54.80	—0.62	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1838, Dec. 30	δ Geminorum	7	10	32.04	31.78	— 0.26	B
"	α^2 Geminorum	7	24	20.83	20.93	+ 0.10	"
"	β Geminorum	7	35	28.98	29.02	+ 0.04	"
"	12 Can. Ven.	12	48	29.63	29.84	+ 0.21	"
31	δ Geminorum	7	10	31.86	31.80	— 0.06	"
"	15 Argus	8	00	42.71	42.74	+ 0.03	"
"	α Arietis	1	58	06.89	06.94	+ 0.05	"
"	α^2 Geminorum	7	24	20.93	20.94	+ 0.01	"
"	β Geminorum	7	35	28.74	29.04	+ 0.30	"
"	☽'s 2d Limb	7	54	17.90			"
"	η Cancri	7	23	25.32	24.84	— 0.52	"
"	ε Hydræ	8	38	16.44	16.19	— 0.25	"
1839, Jan. 8	ε Bootis	14	37	56.93	57.15	+ 0.22	"
"	☽'s 2d Limb	14	11	38.28			"
"	α^2 Libræ	14	41	58.83	58.61	— 0.22	"
10	γ Pegasi	0	04	56 72	56.83	+ 0.11	"
"	α Cassiopeæ	0	31	23.02	23.52	+ 0.50	"
"	β Ceti	0	35	30.73	30.45	— 0.28	"
"	γ Ceti	2	34	58.70	58.68	— 0.02	"
"	ε Arietis	2	50	01.96	01.75	— 0.21	"
"	α Ceti	2	53	52.83	52.92	+ 0.09	"
"	α Persei	3	12	52.65	52.53	— 0.12	"
"	ε Bootis	14	37	57.15	57.22	+ 0.07	"
"	β Libræ	15	08	20.73	20.67	— 0.06	"
"	α Cor. Bor.	15	27	51.80	51.84	+ 0.04	"
"	☽'s 2d Limb	15	53	31.87			"
"	α Scorpii	16	19	31.76	31.83	+ 0.07	"
18	☽'s 1st Limb	22	47	16.56			"
"	Markab	22	56	43.94	43.94	0.00	"
23	ε Arietis	2	50	01.71	01.56	— 0.15	"
"	α Ceti	2	53	53.01	52.78	— 0.23	"
"	δ Arietis	3	02	26.56	26.46	— 0.10	"
"	☽'s 1st Limb	3	17	02.10			"
"	η Tauri	3	37	56.19	56.26	+ 0.07	"
"	τ Tauri	4	32	36.85	36.45	— 0.40	"
"	Capella	5	04	49.74	49.89	+ 0.15	"
"	γ Draconis	17	52	50.48	50.67	+ 0.19	"
"	α Lyræ	18	31	27.92	27.76	— 0.16	"
Feb. 24	δ Orionis	5	23	48.15	48.07	— 0.08	"
"	α Leporis	5	25	38.72	38.86	+ 0.14	"
"	ε Orionis	5	28	03.79	03.80	+ 0.01	"
"	α Orionis	5	46	28.79	28.57	— 0.22	"
"	μ Geminorum	6	13	14.42	14.57	+ 0.15	"
"	ε Geminorum	6	34	03.29	03.05	— 0.24	"
"	Sirius	6	38	03.98	04.35	+ 0.37	"
"	ι Geminorum	7	15	45.26	45.10	— 0.16	"
"	α^2 Geminorum	7	24	21.29	21.19	— 0.10	"

Date.	Name of Object.	Sidereal Time of Meridian Passage. h.	m.	s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1839, Feb. 24	β Geminorum	7	35	29.57	29.34	— 0.23	B
"	☽'s 1st Limb	8	05	30.06			"
"	λ Cancri	8	10	59.47	58.84	— 0.63	"
"	γ Cancri	8	34	00.11	59.68	— 0.43	"
"	ε Hydræ	8	38	16.92	16.75	— 0.17	"
25	ι Geminorum	7	15	44.89	45.09	+ 0.20	"
"	α^2 Geminorum	7	24	20.83	21.18	+ 0.35	"
"	Procyon	7	30	54.20	53.96	— 0.24	"
"	β Geminorum	7	35	29.51	29.33	— 0.18	"
"	15 Argus	8	00	42.85	42.92	+ 0.07	"
"	λ Cancri	8	10	59.10	58.83	— 0.27	"
"	γ Cancri	8	33	59.74	59.67	— 0.07	"
"	☽'s 1st Limb	8	59	48.59			"
"	λ Leonis	9	22	33.74	33.69	— 0.05	"
"	ο Leonis	9	32	35.31	35.24	— 0.07	"
March 1	Capella	5	04	49.59	49.23	— 0.36	"
"	β Tauri	5	16	08.06	08.13	+ 0.07	"
"	Sirius	6	38	04.57	04.29	— 0.28	"
"	δ Orionis	5	23	47.78	48.00	+ 0.22	"
"	α Leporis	5	25	38.01	38.77	+ 0.76	"
"	ε Orionis	5	28	03.50	03.73	+ 0.23	"
"	α Columbæ	5	33	50.56	50.22	— 0.34	"
"	α Orionis	5	46	28.00	28.51	+ 0.51	"
"	υ Leonis	11	28	44.06	43.27	— 0.79	"
"	β Virginis	11	42	20.59	20.65	+ 0.06	"
"	☽'s 2d Limb	12	07	15.94			"
"	η Virginis	12	11	42.03	41.94	— 0.09	"
"	q Virginis	12	25	30.23	30.09	— 0.14	"
"	γ^1 Virginis	12	33	32.46	32.84	+ 0.38	"
3	Capella	5	05	49.44	49.20	— 0.24	"
"	Rigel	5	06	49.44	48.95	— 0.49	"
"	β Tauri	5	16	08.10	08.09	— 0.01	"
"	δ Orionis	5	23	47.74	47.96	+ 0.22	"
"	α Leporis	5	25	38.25	38.72	+ 0.47	"
"	ε Orionis	5	28	03.49	03.69	+ 0.20	"
"	α Columbæ	5	33	50.41	50.18	— 0.23	"
"	Sirius	6	38	04.14	04.25	+ 0.11	"
"	ϑ Virginis	13	01	38.83	39.02	+ 0.19	"
"	α Virginis	13	16	44.95	44.76	— 0.19	"
"	☽'s 2d Limb	13	34	32.97			"
"	x Virginis	13	41	09.81	09.35	— 0.46	"
"	Arcturus	14	08	20.73	20.84	+ 0.11	"
"	ε Bootis	14	37	58.52	58.93	+ 0.41	"
"	α^2 Libræ	14	42	00.09	00.36	+ 0.27	"
"	β Libræ	15	08	22.43	22.33	— 0.10	"
"	α Scorpii	16	19	34.10	33.62	— 0.48	"
4	α Virginis	13	16	44.74	44.78	+ 0.04	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1839, March 4	χ Virginis	13 41 09.58	09.37	— 0.21	B
"	Arcturus	14 08 21.26	20.87	— 0.39	"
"	☽'s 2d Limb	14 20 29.74			"
"	ε Bootis	14 37 58.98	58.96	— 0.02	"
"	α^2 Libræ	14 42 00.32	00.39	+ 0.07	"
"	Libræ	14 48 06.32			"
"	α Herculis	17 07 18.95	19.08	+ 0.13	"
"	γ Draconis	17 52 51.87	52.06	+ 0.19	"
5	Capella	5 04 49.31	49.14	— 0.17	"
"	β Tauri	5 16 08.08	08.06	— 0.02	"
"	δ Orionis	5 23 47.81	47.93	+ 0.12	"
"	α Leporis	5 25 38.73	38.70	— 0.03	"
"	ε Orionis	5 28 03.38	03.66	+ 0.28	"
"	α Columbæ	5 33 50.30	50.13	— 0.17	"
"	α^2 Libræ	14 42 00.30	00.42	+ 0.12	"
"	☽'s 2d Limb	15 09 12.76			"
"	γ^1 Libræ	15 26 33.17	32.86	— 0.31	"
"	α Serpentis	15 36 21.80	21.59	— 0.21	"
"	β^1 Scorpii	15 56 06.20	06.17	— 0.03	"
"	α Scorpii	16 19 33.64	33.69	+ 0.05	"
"	α Herculis	17 07 19.02	19.11	+ 0.09	"
7	Capella	5 04 49.18	49.09	— 0.09	W
"	Rigel	5 06 48.87	48.89	+ 0.02	"
"	β Tauri	5 16 08.42	08.02	— 0.40	"
"	α Leporis	5 25 38.53	38.66	+ 0.13	"
"	ε Orionis	5 28 03.10	03.63	+ 0.53	B
"	☽'s 2d Limb	16 57 08.32			W
"	A Ophiuchi	17 05 27.38	28.14	+ 0.76	"
"	α Herculis	17 07 18.95	19.17	+ 0.22	"
"	ϑ Ophiuchi	17 12 08.09	08.30	+ 0.21	"
"	α Ophiuchi	17 27 28.34	28.28	— 0.06	"
"	α Lyræ	18 31 29.11	28.95	— 0.16	"
10	Capella	5 04 48.79	49.02	+ 0.23	"
"	Rigel	5 06 48.81	48.83	+ 0.02	B
"	β Tauri	5 16 07.95	07.97	+ 0.02	"
"	δ Orionis	5 23 48.03	47.85	— 0.18	"
"	α Leporis	5 25 38.97	38.61	— 0.36	"
"	ε Orionis	5 28 03.48	03.57	+ 0.09	"
"	α Columbæ	5 33 49.87	50.01	+ 0.14	"
"	γ Draconis	17 52 52.18	52.30	+ 0.12	"
"	α Lyræ	18 31 29.37	29.05	— 0.32	"
"	☽'s 2d Limb	17 57 53.22			"
"	β Lyræ	18 44 08.30	08.14	— 0.16	"
"	α Cygni	20 35 55.09	55.46	+ 0.37	"
22	☽'s 1st Limb	6 48 28.23			"
"	δ Geminorum	7 10 32.11	31.58	— 0.53	"
"	ι Geminorum	7 15 44.83	44.71	— 0.12	"

Date.	Name of Object.	Sidereal Time of Meridian Passage. h.	m.	s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1839, March 22	α^2 Geminorum	7	24	20.77	20.80	+ 0.03	B
"	Procyon	7	30	53.65	53.65	0.00	"
"	β Geminorum	7	35	29.04	28.99	+ 0.05	"
23	Procyon	7	30	53.52	53.63	+ 0.11	"
"	β Geminorum	7	35	29.31	28.97	— 0.34	"
"	☽'s 1st Limb	7	48	09.23			"
"	γ Aquilæ	19	38	36.26	36.57	+ 0.31	"
"	α Aquilæ	19	42	55.98	55.91	— 0.07	"
24	Sirius	6	38	03.74	03.89	+ 0.15	"
"	α Persei	3	12	50.92	50.96	+ 0.04	"
"	β Geminorum	7	35	28.82	28.96	+ 0.14	"
"	6 Cancri	7	53	38.60	38.49	— 0.11	"
"	μ^1 Cancri	7	56	47.30	47.10	— 0.20	"
"	15 Argus	8	00	42.54	42.54	0.00	"
"	ϑ Cancri	8	22	26.26	26.20	— 0.06	"
"	☽'s 1st Limb	8	43	28.82			"
"	ξ Cancri	9	00	07.26	07.46	+ 0.20	"
"	q Cancri	9	10	01.22	00.98	— 0.24	"
25	Sirius	6	38	03.99	03.87	— 0.12	"
"	Procyon	7	30	53.36	53.60	+ 0.24	"
"	β Geminorum	7	35	29.12	28.94	— 0.18	"
"	ξ Cancri	9	00	07.66	07.45	— 0.21	"
"	q Cancri	9	10	01.07	00.97	— 0.10	"
"	α Hydræ	9	19	42.01	42.18	+ 0.17	"
"	☽'s 1st Limb	9	34	31.73			"
"	ν Leonis	9	49	34.97	35.39	+ 0.42	"
"	η Leonis	9	58	34.73	35.00	+ 0.27	"
26	Capella	5	04	48.85	48.65	— 0.20	"
"	ε Canis Maj.	6	52	18.74	18.74	0.00	"
"	ν Leonis	9	49	35.50	35.39	— 0.11	"
"	η Leonis	9	58	35.24	34.99	— 0.25	"
"	γ Leonis	10	11	07.46	07.20	— 0.26	"
"	☽'s 1st Limb	10	22	02.01			"
"	ρ Leonis	10	24	21.93	21.79	— 0.14	"
"	l Leonis	10	40	49.12	49.27	+ 0.15	"
30	β Virginis	11	42	20.65	20.86	+ 0.21	"
"	ψ Virginis	12	46	01.28	01.40	+ 0.12	"
"	ϑ Virginis	13	01	38.94	39.40	+ 0.46	"
"	α Virginis	13	16	45.12	45.20	+ 0.08	"
"	☽'s 2d Limb	13	19	07.15			"
"	o Virginis	13	37	23.79	23.80	+ 0.01	"
"	α Lyræ	18	31	29.59	29.72	+ 0.13	"
31	α Tauri	4	26	41.34	41.45	+ 0.11	"
"	Rigel	5	06	48.28	48.48	+ 0.20	"
"	δ Orionis	5	23	47.47	47.48	+ 0.01	"
"	α Leporis	5	25	38.55	38.22	— 0.33	"
"	ε Orionis	5	28	03.20	03.24	+ 0.04	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1839, March 31	ι Urs. Maj.	8	48	11.57	11.56	— 0.01	B
"	ξ Cancri	9	00	07.39	07.40	+ 0.01	"
"	α Hydræ	9	19	42.19	42.13	— 0.06	"
"	α Leonis	9	59	49.71	49.66	— 0.05	"
"	α Virginis	13	16	45.06	45.21	+ 0.15	"
"	ο Virginis	13	37	23.87	23.81	— 0.06	"
"	☽'s 2d Limb	14	04	22.30			"
"	λ Virginis	14	10	26.43	26.67	+ 0.24	"
April 7	β Lyræ	18	44	09.07	09.05	— 0.02	"
"	τ Sagittarii	18	56	54.59	54.48	— 0.11	"
"	γ Aquilæ	19	38	37.09	37.02	— 0.07	"
"	α Aquilæ	19	42	56.37	56.34	— 0.03	"
"	☽'s 2d Limb	20	30	43.81			"
"	α Cygni	20	35	56.20	56.33	+ 0.13	"
8	α Aquilæ	19	42	56.11	56.37	+ 0.26	"
"	α Cygni	20	35	56.63	56.36	— 0.27	"
"	☽'s 2d Limb	21	27	40.48			"
16	☽'s 1st Limb	4	11	34.62			W
"	α Tauri	4	26	41.44	41.30	— 0.14	"
"	Capella	5	04	48.20	48.26	+ 0.06	"
"	β Orionis	5	06	48.30	48.28	— 0.02	"
"	α Orionis	5	46	27.72	27.80	+ 0.08	"
20	Capella	5	04	48.21	48.20	— 0.01	"
"	Rigel	5	06	47.99	48.21	+ 0.22	"
"	β Tauri	5	16	07.48	07.32	— 0.16	"
"	α Orionis	5	46	27.84	27.75	— 0.09	"
"	12 Can. Ven.	12	48	32.31	32.41	+ 0.10	B
"	Procyon	7	30	53.35	53.20	— 0.15	"
"	β Geminorum	7	35	28.29	28.49	+ 0.20	"
"	☽'s 1st Limb	8	25	30.65			"
"	γ Cancri	8	33	59.44	59.03	— 0.41	"
"	δ Cancri	8	35	33.17	33.03	— 0.14	"
"	ε Hydræ	8	38	16.21	16.16	— 0.05	"
"	ι Urs. Maj.	8	48	11.09	11.07	— 0.02	"
"	ξ Cancri	9	00	07.22	07.10	— 0.12	"
21	Procyon	7	30	53.21	53.18	— 0.03	"
"	β Geminorum	7	35	28.41	28.47	+ 0.06	"
"	δ Cancri	8	35	33.23	33.03	— 0.20	"
"	ε Hydræ	8	38	16.18	16.15	— 0.03	"
"	ξ Cancri	9	00	07.67	07.08	— 0.59	"
"	☽'s 1st Limb	9	18	29.41			"
"	λ Leonis	9	22	33.84	33.20	— 0.64	"
23	Sirius	6	38	03.47	03.37	— 0.10	"
"	ρ Leonis	10	24	21.15	21.57	+ 0.42	"
"	☽'s 1st Limb	10	52	47.22			"
"	δ Leonis	11	05	34.10	34.32	+ 0.22	"
"	τ Leonis	11	19	41.24	41.45	+ 0.21	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1839, April 23	β Leonis	11 40 52.69	52.82	+ 0.13	B
"	γ Urs. Maj.	11 45 23.55	23.38	— 0.17	"
24	δ Leonis	11 05 34.44	34.31	— 0.13	"
"	υ Leonis	11 28 44.46	44.24	— 0.22	"
"	☽'s 1st Limb	11 36 27.37			"
"	β Leonis	11 40 52.75	52.80	+ 0.05	"
"	γ Urs. Maj.	11 45 23.30	23.36	+ 0.06	"
"	o Virginis	11 57 02.87	02.66	— 0.21	"
25	o Virginis	11 57 02.31	02.66	+ 0.35	"
"	δ Leonis	11 05 33.78	34.30	+ 0.52	"
"	σ Leonis	11 12 51.75	52.16	+ 0.41	"
"	β Virginis	11 42 20.63	20.79	+ 0.16	"
"	γ Urs. Maj.	11 45 23.56	23.36	— 0.20	"
"	☽'s 1st Limb	12 19 21.12			"
"	β Corvi	12 25 58.84	58.54	— 0.30	"
"	γ^1 Virginis	12 33 32.31	32.40	+ 0.09	"
26	β Corvi	12 25 58.49	58.54	+ 0.05	W
"	γ^1 Virginis	12 33 32.34	32.29	— 0.05	"
"	ψ Virginis	12 46 01.06	01.51	+ 0.45	"
"	12 Can. Ven.	12 48 32.71	32.40	— 0.31	"
"	☽'s 1st Limb	13 02 35.75			"
"	α Virginis	13 16 45.09	45.38	+ 0.29	"
"	β Leonis	11 40 52.49	52.80	+ 0.31	"
"	γ Urs. Maj.	11 45 23.36	23.38	+ 0.02	"
27	Spica	13 16 45.28	45.39	+ 0.11	B
"	m Virginis	13 33 13.02	12.50	— 0.52	"
"	o Virginis	13 37 24.66	23.98	— 0.68	"
"	☽'s 1st Limb	13 47 13.09			"
"	Arcturus	14 08 21.79	21.71	— 0.08	"
"	λ Virginis	14 10 26.66	27.00	+ 0.34	"
May 4	δ Aquilæ	19 17 24.50	24.33	— 0.17	"
"	h^2 Sagittarii	19 26 56.07	56.35	+ 0.28	"
"	γ Aquilæ	19 38 37.92	37.82	— 0.10	"
"	α Aquilæ	19 42 56.91	57.16	+ 0.25	"
"	☽'s 2d Limb	20 10 57.41			"
"	α Cygni	20 35 57.28	57.32	+ 0.04	"
5	α^2 Capricorni	20 09 08.61	08.64	+ 0.03	"
"	α Cygni	20 35 57.39	57.36	— 0.03	"
"	☽'s 2d Limb	21 05 56.36			"
15	Capella	5 04 48.56	48.07	— 0.49	"
"	☽'s 1st Limb	5 53 31.41			"
"	α^2 Geminorum	7 24 20.19	19.95	— 0.24	"
"	Procyon	7 30 52.56	52.92	+ 0.36	"
"	β Geminorum	7 35 27.64	28.16	+ 0.52	"
25	β Leonis	11 40 52.34	52.54	+ 0.20	"
"	γ Urs. Maj.	11 45 22.80	22.73	— 0.07	"
"	o Virginis	11 57 02.24	02.45	+ 0.21	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1839, May 25	γ^1 Virginis	12 33 32.57	32.17	— 0.40	B
"	12 Can. Ven.	12 48 32.16	32.16	0.00	"
"	Arcturus	14 08 21.91	21.76	— 0.15	"
"	λ Virginis	14 10 26.89	27.11	+ 0.22	"
"	☽'s 1st Limb	14 17 53.48			"
30	☽'s 2d Limb	18 54 13.02			"
"	τ Sagittarii	18 56 56.18	56.21	+ 0.03	"
"	h^2 Sagittarii	19 26 57.04	57.18	+ 0.14	"
"	δ Aquilæ	19 17 25.07	25.07	0.00	"
"	γ Aquilæ	19 38 38.43	38.57	+ 0.14	"
"	α Aquilæ	19 42 57.98	57.91	— 0.07	"
"	β Aquilæ	19 47 26.62	26.55	— 0.07	"
June 3	12 Can. Ven.	12 48 32.13	32.05	— 0.08	"
"	α Virginis	13 16 45.41	45.35	— 0.06	"
"	ε Pegasi	21 36 18.72	18.52	— 0.20	"
"	☽'s 2d Limb	22 34 31.52			"
"	Fomalhaut	22 48 46.10	46.25	+ 0.15	"
"	α Pegasi	22 56 45.91	45.99	+ 0.08	"
14	Procyon	7 30 52.70	52.80	+ 0.10	"
"	β Geminorum	7 35 28.08	28.03	— 0.05	"
"	☽'s 1st Limb	8 32 57.31			"
"	α Hydræ	9 19 41.43	41.28	— 0.15	"
"	α Leonis	9 59 48.78	48.87	+ 0.09	"
15	Sirius	6 38 03.25	03.06	— 0.19	"
"	Procyon	7 30 52.76	52.80	+ 0.04	"
"	☽'s 1st Limb	9 27 35.68			"
"	α Leonis	9 59 48.70	48.87	+ 0.17	"
17	Sirius	6 38 03.14	03.07	— 0.07	"
"	Procyon	7 30 52.84	52.81	— 0.03	"
"	β Geminorum	7 35 27.93	28.03	+ 0.10	"
"	☽'s 1st Limb	11 03 26.16			"
19	Sirius	6 38 03.22	03.07	— 0.15	"
"	β Leonis	11 40 52.35	52.32	— 0.03	"
"	γ Urs. Maj.	11 45 22.18	22.13	— 0.05	"
"	☽'s 1st Limb	12 31 18.14			"
"	12 Can. Ven.	12 48 31.73	31.82	+ 0.09	"
"	Spica	13 16 45.41	45.25	— 0.16	"
"	m Virginis	13 33 12.39	12.20	— 0.19	"
"	χ Virginis	13 41 10.42	10.18	— 0.24	"
"	η Bootis	13 47 03.46	03.64	+ 0.18	"
20	12 Can. Ven.	12 48 31.45	31.81	+ 0.36	"
"	☽'s 1st Limb	13 15 05.64			"
"	α Virginis	13 16 45.41	45.24	— 0.17	"
"	ε Bootis	14 37 59.80	59.98	+ 0.18	"
"	α^2 Libræ	14 42 01.80	01.69	— 0.11	"
"	α Serpentis	15 36 23.45	23.20	— 0.25	"
22	α^2 Libræ	14 42 01.71	01.68	— 0.03	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1839, June 22	ι Libræ	15 03 06.32	06.13	—0.19	B
"	☽'s 1st Limb	14 48 19.95			"
"	β Libræ	15 08 23.91	23.84	—0.07	"
23	Sirius	6 38 03.12	03.10	—0.02	"
"	Arcturus	14 08 21.67	21.62	—0.05	"
"	ι Libræ	15 03 06.07	06.13	+0.06	"
"	β Libræ	15 08 23.84	23.84	0.00	"
"	☽'s 1st Limb	15 39 33.68			"
"	π Scorpii	15 49 10.96	10.60	—0.36	"
"	β^1 Scorpii	15 56 08.18	08.18	0.00	"
"	σ Scorpii	16 11 28.59	28.01	—0.58	"
"	Antares	16 19 35.63	36.02	+0.39	"
"	η Draconis	16 22 52.97	52.74	—0.23	"
"	α Andromedæ	0 0 06.14	06.04	—0.10	"
25	α Cor. Bor.	15 27 55.16	55.04	—0.12	"
"	α Serpentis	15 36 23.19	23.19	0.00	"
"	b Scorpii	15 41 21.82	21.60	—0.22	"
"	β^1 Scorpii	15 56 08.11	08.18	+0.07	"
"	Antares	16 19 35.98	36.02	+0.04	"
"	A Ophiuchi	17 05 30.24	30.82	+0.58	"
"	☽'s 1st Limb	17 32 06.32			"
"	γ^2 Sagittarii	17 55 31.65	31.88	+0.23	"
"	p Sagittarii	17 37 29.08	29.24	+0.16	"
26	α^2 Libræ	14 42 01.68	01.67	—0.01	"
"	β Libræ	15 08 23.91	23.83	—0.08	"
"	α Serpentis	15 36 23.27	23.19	—0.08	"
"	Antares	16 19 35.76	35.93	+0.17	"
"	μ^1 Sagittarii	18 04 11.78	11.71	—0.07	"
"	δ Sagittarii	18 10 45.41	45.19	—0.22	"
"	λ Sagittarii	18 18 05.86	05.85	—0.01	"
"	☽'s 1st Limb	18 31 33.61			"
"	☽'s 2d Limb	18 33 57.78			"
"	φ Sagittarii	18 35 39.86	39.42	—0.44	"
"	σ Sagittarii	18 45 20.79	20.43	—0.36	"
"	τ Sagittarii	18 56 57.62	56.84	—0.78	"
29	ζ Cygni	21 06 07.73	07.68	—0.05	"
"	α Cephei	21 14 46.17	45.88	—0.29	"
"	☽'s 2d Limb	21 26 03.50			"
"	δ Capricorni	21 38 11.91	11.71	—0.20	"
"	ι Aquarii	21 57 47.51	46.99	—0.52	"
"	σ Aquarii	22 22 09.37	10.05	+0.68	"
"	ζ Pegasi	22 33 28.23	28.26	+0.03	"
"	λ Aquarii	22 43 15.06	15.19	+0.13	"
"	Fomalhaut	22 48 47.18	47.19	+0.01	"
"	α Pegasi	22 56 46.55	46.84	+0.29	"
30	Spica	13 16 45.19	45.16	—0.03	"
"	12 Can. Ven.	12 48 31.67	31.66	—0.01	"

Date.	Name of Object.	Sidereal Time of Meridian Passage. h.	m.	s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1839, June 30	β Aquarii	21	23	07.36	07.58	+ 0.22	B
"	δ Capricorni	21	38	12.05	11.71	— 0.34	"
"	☽'s 2d Limb	22	18	46.68			"
"	σ Aquarii	22	22	10.22	10.05	— 0.17	"
"	λ Aquarii	22	44	15.12	15.22	+ 0.10	"
"	Fomalhaut	22	48	47.44	47.22	— 0.22	"
"	α Pegasi	22	56	46.87	46.88	— 0.01	"
July 1	σ Aquarii	22	22	10.22	10.08	— 0.14	"
"	ζ Pegasi	22	33	28.60	28.32	— 0.28	"
"	λ Aquarii	22	43	15.04	15.25	+ 0.21	"
"	Fomalhaut	22	48	47.39	47.25	— 0.14	"
"	α Pegasi	22	56	46.45	46.90	+ 0.45	"
"	φ Aquarii	23	06	01.30	01.41	+ 0.11	"
"	☽'s 2d Limb	23	09	50.02			"
"	ι Piscium	23	31	42.31	42.27	— 0.04	"
3	☽'s 2d Limb	0	51	53.37			"
"	α Tauri	4	26	41.86	42.04	+ 0.18	"
"	Capella	5	04	48.98	48.84	— 0.14	"
"	Rigel	5	26	48.66	48.64	— 0.02	"
"	α Orionis	5	46	27.86	28.00	+ 0.14	"
"	Sirius	6	38	03.34	03.20	— 0.14	"
6	☽'s 2d Limb	3	45	09.35			"
"	Capella	5	04	48.97	48.97	0.00	"
"	Sirius	6	38	03.23	03.23	0.00	"
7	α Andromedæ	0	00	06.42	06.53	+ 0.11	"
"	γ Pegasi	0	04	59.10	59.22	+ 0.12	"
"	α Cassiopeæ	0	31	26.30	26.07	— 0.23	"
"	α Tauri	4	26	41.55	41.52	— 0.03	"
"	☽'s 2d Limb	4	50	55.07			"
"	Rigel	5	06	48.53	48.72	+ 0.19	"
"	β Tauri	5	16	07.46	07.97	+ 0.51	"
"	Sirius	6	38	03.84	03.25	— 0.59	"
12	☽'s 1st Limb	9	02	39.41			"
"	α Leonis	9	59	48.80	48.76	— 0.04	"
"	Spica	13	16	45.04	45.05	+ 0.01	"
"	β Libræ	15	08	23.67	23.75	+ 0.08	"
"	Antares	16	19	36.06	36.02	— 0.04	"
16	☽'s 1st Limb	12	13	13.37			"
"	12 Can. Ven.	12	48	31.17	31.41	+ 0.24	"
"	Spica	13	16	45.02	45.01	— 0.01	"
"	η Urs. Maj.	13	41	13.39	13.37	— 0.02	"
"	η Bootis	13	47	03.27	03.38	+ 0.11	"
"	Sirius	6	38	03.22	03.38	+ 0.16	"
17	γ^1 Virginis	12	33	31.75	31.74	— 0.01	"
"	☽'s 1st Limb	12	57	03.63			"
"	Spica	13	16	45.06	45.00	— 0.06	"
"	η Urs. Maj.	13	41	13.97	13.35	— 0.62	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1839, July 17	η Bootis	13	47	03.40	03.36	— 0.04	B
"	Arcturus	14	08	21.27	21.37	+ 0.10	"
"	ε Bootis	13	37	59.85	59.69	— 0.16	"
"	α^2 Libræ	14	42	01.35	01.51	+ 0.16	"
"	α Tauri	4	26	42.57	42.47	— 0.10	"
"	Capella	5	04	49.41	49.35	— 0.06	"
"	Rigel	5	06	49.01	48.96	— 0.05	"
"	β Tauri	5	16	08.06	08.22	+ 0.16	"
"	ε Orionis	5	28	03.63	03.59	— 0.04	"
"	Sirius	6	38	03.42	03.48	+ 0.06	"
23	ϑ Ophiuchi	17	12	10.69	11.06	+ 0.37	W
"	p Sagittarii	17	37	29.81	29.38	— 0.43	"
"	γ Draconis	17	52	54.92	55.00	+ 0.08	"
"	☽'s 1st Limb	18	07	23.86			"
"	λ Sagittarii	18	18	05.81	05.89	+ 0.08	"
"	α Lyræ	18	31	32.65	32.00	— 0.65	"
"	σ Sagittarii	18	45	20.61	20.72	+ 0.11	"
"	ζ Aquilæ	18	58	03.78	03.76	— 0.02	"
"	α Tauri	4	26	42.64	42.65	+ 0.01	"
"	Capella	5	04	49.69	49.57	— 0.12	"
"	Rigel	5	06	48.99	49.10	+ 0.11	"
26	ψ Capricorni	20	36	37.26	37.34	+ 0.08	B
"	☽'s 2d Limb	21	06	02.22			"
"	β Aquarii	21	23	07.72	08.13	+ 0.41	"
"	γ Capricorni	21	31	13.34	13.40	+ 0.06	"
"	ε Pegasi	21	36	19.88	19.87	— 0.01	"
"	α Aquarii	21	57	33.95	34.04	+ 0.09	"
"	ϑ Aquarii	22	08	23.46	23.07	— 0.39	"
"	ζ Pegasi	22	33	29.08	28.95	— 0.13	"
"	Fomalhaut	22	48	48.04	48.02	— 0.02	"
"	α Pegasi	22	56	47.92	47.58	— 0.34	"
27	ε Pegasi	21	36	19.69	19.89	+ 0.20	"
"	α Aquarii	21	57	34.19	34.06	— 0.13	"
"	☽'s 2d Limb	22	00	34.97			"
"	ϑ Aquarii	22	08	23.15	23.09	— 0.06	"
"	σ Aquarii	22	22	11.22	10.75	— 0.47	"
"	ζ Pegasi	22	33	29.05	28.97	— 0.08	"
August 23	γ Aquilæ	19	38	39.38	39.51	+ 0.13	"
"	α Aquilæ	19	42	58.65	58.91	+ 0.26	"
"	β Aquilæ	19	47	27.51	27.59	+ 0.08	"
"	α^2 Capricorni	20	09	10.89	10.74	— 0.15	"
"	α Cygni	20	35	59.78	59.56	— 0.22	"
"	ζ Cygni	21	06	08.45	08.36	— 0.09	"
"	☽'s 1st Limb	21	34	41.58			"
"	Rigel	5	06	49.86	49.96	+ 0.10	"
24	Antares	16	19	35.68	35.59	— 0.09	"
"	α^2 Capricorni	20	09	10.72	10.74	+ 0.02	"

Date.	Name of Object.	Sidereal Time of Meridian Passage. h.	m.	s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1839, Aug. 24	α Cygni	20	35	59.60	59.55	— 0.05	B
"	η Capricorni	20	55	18.65	18.14	— 0.51	"
"	61′ Cygni	20	59	44.58	44.80	+ 0.22	"
"	ζ Cygni	21	06	08.49	08.36	— 0.13	"
"	☽'s 1st Limb	22	28	58.23			"
"	☽'s 2d Limb	22	31	14.61			"
25	λ Aquarii	22	44	16.10	16.45	+ 0.35	"
"	Fomalhaut	22	48	48.84	48.59	— 0.25	"
"	α Pegasi	22	56	47.97	48.10	+ 0.13	"
"	☽'s 2d Limb	23	24	09.31			"
"	ι Piscium	23	31	43.57	43.68	+ 0.11	"
"	q Piscium	23	53	37.99	38.01	+ 0.02	"
"	α Andromedæ	0	00	07.61	07.83	+ 0.22	"
"	γ Pegasi	0	05	00.71	00.47	— 0.24	"
"	α Cassiopeæ	0	31	28.31	27.97	— 0.34	"
"	β Ceti	0	35	33.81	33.83	+ 0.02	"
"	δ Piscium	0	40	23.28	23.41	+ 0.13	"
"	α Tauri	4	26	43.84	43.65	— 0.19	"
"	Capella	5	04	51.19	50.86	— 0.33	"
"	Rigel	5	06	49.73	49.99	+ 0.26	"
"	β Tauri	5	16	09.49	09.44	— 0.05	"
"	ε Orionis	5	28	04.24	04.59	+ 0.35	"
"	α Orionis	5	46	29.33	29.28	— 0.05	"
26	α Herculis	17	07	21.04	21.00	— 0.04	"
"	γ Draconis	17	52	53.90	54.28	+ 0.38	"
"	μ¹ Sagittarii	18	04	11.51	11.69	+ 0.18	"
"	α Lyræ	18	31	31.72	31.59	— 0.13	"
"	γ Aquilæ	19	38	39.45	39.49	— 0.04	"
"	α Aquilæ	19	42	58.81	58.89	— 0.08	"
"	β Aquilæ	19	47	27.77	27.57	— 0.20	"
"	q Piscium	23	53	38.12	38.01	— 0.11	"
"	☽'s 2d Limb	0	16	51.68			"
"	α Cassiopeæ	0	31	28.31	28.09	— 0.22	"
27	α Herculis	17	07	20.66	20.99	+ 0.33	W
"	β Draconis	17	26	49.79	49.78	— 0.01	"
"	α Lyræ	18	31	31.91	31.58	— 0.33	"
"	☽'s 2d Limb	1	10	37.34			B
28	η Piscium	1	22	56.05	55.84	— 0.21	"
"	ο Piscium	1	36	57.14	56.94	— 0.20	"
"	β Arietis	1	45	48.83	48.58	— 0.25	"
"	α Arietis	1	58	09.80	09.70	— 0.10	"
"	☽'s 2d Limb	2	06	39.10			"
"	χ Arietis	2	22	01.98	01.86	— 0.12	"
"	γ Ceti	2	35	00.76	00.92	+ 0.16	"
"	ν Arietis	2	29	44.20	43.85	— 0.35	"
Sept. 1	Antares	16	19	35.52	35.47	— 0.05	"
"	α Herculis	17	07	20.89	20.93	+ 0.04	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1839, Sept. 1	α Tauri	4 26 43.64	43.87	+ 0.23	B
"	Capella	5 04 51.09	51.16	+ 0.07	"
"	β Orionis	5 06 50.06	50.20	+ 0.14	"
"	β Tauri	5 16 09.71	09.68	— 0.03	"
"	δ Orionis	5 23 49.27	49.13	— 0.14	"
"	ϵ Orionis	5 28 05.06	04.80	— 0.26	"
"	α Orionis	5 46 29.71	29.49	— 0.22	"
"	☽'s 2d Limb	6 18 28.64			"
"	Sirius	6 38 04.13	04.38	+ 0.25	"
10	Capella	5 04 51.67	51.59	— 0.08	"
"	Rigel	5 06 50.52	50.50	— 0.02	"
"	β Tauri	5 16 10.01	10.02	+ 0.01	"
"	δ Orionis	5 23 49.26	49.42	+ 0.16	"
"	α Leporis	5 25 40.00	39.92	— 0.08	"
"	ϵ Orionis	5 28 05.07	05.10	+ 0.03	"
"	☽'s 1st Limb	13 50 43.85			"
"	Arcturus	14 08 20.12	20.66	+ 0.54	"
"	α Serpentis	15 36 22.37	22.37	0.00	"
13	Sirius	6 38 04.84	04.74	— 0.10	"
"	☽'s 1st Limb	16 20 54.31			"
"	α Herculis	17 07 20.69	20.69	0.00	"
"	α Lyræ	18 31 31.38	31.18	— 0.20	"
15	Antares	16 19 35.41	35.22	— 0.19	"
"	☽'s 1st Limb	17 16 37.78			"
"	α Lyræ	18 31 31.16	31.15	— 0.01	"
"	β Lyræ	18 44 10.17	10.46	+ 0.29	"
"	ξ Aquilæ	18 58 03.43	03.35	— 0.08	"
"	δ Aquilæ	19 17 25.68	25.65	— 0.03	"
"	β Aquilæ	19 47 27.35	27.37	+ 0.02	"
16	☽'s 1st Limb	18 14 20.87			"
"	δ Aquilæ	19 17 25.61	25.64	+ 0.03	"
"	γ Aquilæ	19 38 39.32	39.26	— 0.06	"
"	α Aquilæ	19 42 58.65	58.67	+ 0.02	"
18	μ^1 Sagittarii	18 04 11.23	11.34	+ 0.11	W
"	α Aquilæ	19 42 58.67	58.64	— 0.03	"
"	β Aquilæ	19 47 27.54	27.33	— 0.21	"
"	α^2 Capricorni	20 09 10.59	10.54	— 0.05	"
"	☽'s 1st Limb	20 10 47.08			"
"	π Capricorni	20 18 09.92	09.70	— 0.22	"
"	α Cygni	20 35 59.04	59.21	+ 0.17	"
19	α^2 Capricorni	20 09 10.56	10.53	— 0.03	"
"	π Capricorni	20 18 10.05	09.69	— 0.36	"
"	χ Capricorni	20 36 37.49	37.36	— 0.13	"
"	☽'s 1st Limb	21 07 18.77			B
"	β Aquarii	21 23 08.29	08.37	+ 0.08	"
"	γ Capricorni	21 31 13.44	13.70	+ 0.26	"
"	ϵ Pegasi	21 36 20.17	20.13	— 0.04	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1839, Sept. 20	γ Draconis	17	52	53.06	53.47	+ 0.41	B
"	μ^1 Sagittarii	18	04	11.21	11.31	+ 0.10	"
"	α Lyræ	18	31	31.23	31.03	— 0.20	"
"	ζ Aquilæ	18	58	03.41	03.27	— 0.14	"
"	δ Aquilæ	19	17	25.82	25.58	— 0.24	"
"	γ Aquilæ	19	38	39.46	39.20	— 0.26	"
"	α Aquilæ	19	42	58.41	58.61	+ 0.20	"
"	β Aquilæ	19	47	27.25	27.30	+ 0.05	"
"	α^2 Capricorni	20	09	10.57	10.52	— 0.05	"
"	ζ Cygni	21	06	08.40	08.17	— 0.23	"
"	γ Capricorni	21	31	13.92	13.70	— 0.22	"
"	ε Pegasus	21	36	19.98	20.13	+ 0.15	"
"	☽'s 1st Limb	22	02	14.46			"
"	ζ Pegasi	22	33	29.47	29.52	+ 0.05	"
"	Fomalhaut	22	48	48.67	48.78	+ 0.11	"
21	β Aquilæ	19	47	27.53	27.29	— 0.24	"
"	ζ Cygni	21	06	08.02	08.16	+ 0.14	"
"	β Aquarii	21	23	08.32	08.36	+ 0.04	"
"	γ Capricorni	21	31	13.59	13.70	+ 0.11	"
"	ε Pegasi	21	36	20.15	20.12	— 0.03	"
"	ϑ Aquarii	22	08	24.08	23.74	— 0.34	"
"	σ Aquarii	22	22	11.10	11.27	+ 0.17	"
"	☽'s 1st Limb	22	55	58.84			"
"	φ Aquarii	23	06	02.94	02.88	— 0.06	"
"	κ^1 Piscium	23	18	44.58	44.59	+ 0.01	"
23	α Andromedæ	0	00	08.47	08.22	— 0.25	"
"	γ Pegasi	0	05	01.20	00.86	— 0.34	"
"	δ Piscium	0	12	23.10	22.85	— 0.25	"
"	☽'s 2d Limb	0	46	11.39			"
"	η Piscium	1	22	56.99	56.38	— 0.61	"
"	α Tauri	4	25	44.53	44.58	+ 0.05	"
"	Capella	5	04	51.73	52.20	+ 0.47	"
"	Rigel	5	06	50.83	50.87	+ 0.04	W
"	β Tauri	5	16	10.26	10.47	+ 0.21	"
"	α Leporis	5	25	40.23	40.31	+ 0.08	"
"	ι Orionis	5	28	05.51	05.48	— 0.03	"
"	Sirius	6	38	05.22	05.04	— 0.18	"
26	δ Aquilæ	19	17	25.55	25.49	— 0.06	"
"	γ Aquilæ	19	38	38.83	39.11	+ 0.28	"
"	α Aquilæ	19	42	58.45	58.53	+ 0.08	"
"	β Aquilæ	19	47	26.82	27.22	+ 0.40	"
"	α^2 Capricorni	20	09	10.52	10.44	— 0.08	"
"	α Cygni	20	35	58.74	59.04	+ 0.30	"
"	☽'s 2d Limb	3	46	04.18			B
"	Capella	5	04	52.03	52.27	+ 0.24	"
"	Rigel	5	06	50.55	50.96	+ 0.41	"
"	β Tauri	5	16	10.37	10.57	+ 0.20	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1839, Sept. 26	δ Orionis	5	23	49.89	49.90	+ 0.01	B
"	α Leporis	5	25	40.13	40.40	+ 0.27	"
"	ε Orionis	5	28	05.47	05.57	+ 0.10	"
"	α Columbæ	5	33	51.55	51.45	— 0.10	"
"	μ Geminorum	6	13	16.15	16.19	+ 0.04	"
"	Sirius	6	38	05.50	05.13	— 0.37	"
30	ε Geminorum	6	34	04.46	04.62	+ 0.16	"
"	Sirius	6	38	05.36	05.25	— 0.11	"
"	ε Canis Maj.	6	52	19.82	19.78	— 0.04	"
"	α^2 Geminorum	7	24	22.03	22.22	+ 0.19	W
"	Procyon	7	30	55.01	54.69	+ 0.32	"
"	☽'s 2d Limb	8	03	18.23			B
Oct. 1	ε Canis Maj.	6	52	20.03	19.82	— 0 21	"
"	β Geminorum	7	35	30.05	30.20	+ 0.15	"
"	δ Geminorum	7	10	32.95	33.10	+ 0.15	"
"	Procyon	7	30	54.52	54.72	+ 0.20	"
"	β Geminorum	7	35	30.22	30.23	+ 0.01	"
"	☽'s 2d Limb	8	58	57.05			"
2	δ Geminorum	7	10	33.13	33.13	0.00	"
"	α^2 Geminorum	7	24	22.20	22.29	+ 0.09	"
"	Procyon	7	29	54.72	54.75	+ 0.03	"
"	β Geminorum	7	35	30.39	30.27	— 0.12	"
"	☽'s 2d Limb	9	50	11.29			"
3	α Leonis	9	59	49.55	49.55	0.00	W
"	☽'s 2d Limb	10	37	55.69			"
16	γ Aquilæ	19	38	39.06	38.80	— 0.26	B
"	α Aquilæ	19	42	58.25	58.23	— 0.02	"
"	β Aquilæ	19	47	26.91	26.92	+ 0.01	"
"	c Sagittarii	19	52	48.45	48.46	+ 0.01	"
"	σ Capricorni	20	10	09.20	09.27	+ 0.07	"
"	α Cygni	20	36	58.52	58.56	+ 0.04	"
"	☽'s 1st Limb	20	42	30.27			"
"	η Capricorni	20	55	17.57	17.69	+ 0.12	"
"	61′ Cygni	21	00	48.43	44.13	+ 0.70	"
"	ζ Cygni	21	06	07.92	07.78	— 0.14	"
"	β Aquarii	21	23	08.39	08.10	— 0.29	"
17	α Cygni	20	35	58.82	58.53	— 0.29	"
"	η Capricorni	20	55	17.96	17.68	— 0.28	"
"	61′ Cygni	20	59	43.82	44.11	+ 0.29	"
"	ε Capricorni	21	06	53.50	53.40	— 0.10	"
"	☽'s 1st Limb	21	36	35.84			"
"	Procyon	7	30	54.86	55.23	— 0.37	"
"	β Geminorum	7	35	31.15	30.78	— 0.37	"
18	α Cygni	20	35	58.36	58.51	+ 0.15	"
"	ξ Cygni	21	06	07.86	07.75	— 0.11	"
"	β Aquarii	21	23	08.55	08.08	— 0.47	"
"	δ Capricorni	21	38	12.56	12.38	— 0.18	"

Date.	Name of Object.	Sidereal Time of Meridian Passage			Seconds of Tabular A. R.	Diff.	Observer's Initial.
		h.	m.	s.	s.	s.	
1839, Oct. 18	☽'s 1st Limb	22	28	31.14			B
"	ζ Pegasi	22	33	28.92	29.37	+ 0.45	"
21	ε Pegasi	21	36	19.98	19.81	— 0.17	"
"	α Aquarii	21	57	34.20	34.18	— 0.02	"
"	Fomalhaut	22	48	49.03	48.60	— 0.43	"
"	γ Pegasi	0	05	00.98	00.93	— 0.05	"
"	α Cassiopeæ	0	31	28.50	28.59	+ 0.09	"
"	β Ceti	0	36	34.31	34.43	+ 0.12	"
"	δ Piscium	0	40	23.85	23.98	+ 0.13	"
"	☽'s 1st Limb	1	10	25.66			"
"	ϑ Ceti	1	16	02.71	02.80	+ 0.09	"
"	η Piscium	1	22	57.09	56.68	— 0.41	"
"	β Arietis	1	45	49.44	49.58	+ 0.14	"
22	β Arietis	1	45	49.68	49.58	— 0.10	"
"	α Arietis	1	58	10.74	10.70	— 0.04	"
"	☽'s 2d Limb	2	12	07.85			"
"	γ Ceti	2	35	01.89	02.05	+ 0.16	"
"	π Arietis	2	40	23.64	23.32	— 0.32	"
"	ε Arietis	2	50	05.33	05.28	— 0.05	"
25	Capella	5	04	53.19	53.41	+ 0.22	"
"	Rigel	5	06	51.77	51.75	— 0.02	"
"	β Tauri	5	16	11.48	11.51	+ 0.03	"
"	δ Orionis	5	23	50.85	50.71	— 0.14	"
"	α Leporis	5	25	40.97	41.21	+ 0.24	"
"	☽'s 2d Limb	5	32	04.57			"
"	c Tauri	5	43	16.56	16.83	+ 0.27	"
"	α Orionis	5	46	31.46	31.13	— 0.33	"
"	κ Aurigæ	6	05	11.05	11.39	+ 0.34	"
26	μ Geminorum	6	13	17.45	17.18	— 0.27	"
"	Sirius	6	38	06.28	06.03	— 0.25	"
"	☽'s 2d Limb	6	39	44.98			"
"	ε Canis Maj.	6	52	21.13	20.61	— 0.52	"
"	τ Geminorum	7	00	57.51	57.15	— 0.36	"
"	ι Geminorum	7	15	47.06	47.12	+ 0.06	"
"	α^2 Geminorum	7	24	22.65	23.16	+ 0.51	"
"	Procyon	7	30	55.09	55.50	+ 0.41	"
"	β Geminorum	7	35	30.95	31.10	+ 0.15	"
27	β Geminorum	7	35	31.15	31.15	0.00	"
"	☽'s 2d Limb	7	43	19.68			"
"	6 Cancri	7	53	40.44	40.51	+ 0.07	"
"	15 Argus	8	04	43.65	43.74	+ 0.09	"
"	λ Cancri	8	11	00.46	00.29	— 0.17	"
28	Procyon	7	30	55.59	55.56	— 0.03	"
"	β Geminorum	7	35	31.45	31.17	— 0.28	"
"	6 Cancri	7	53	41.02	40.51	— 0.51	"
"	15 Argus	8	00	43.93	43.77	— 0.16	"
"	λ Cancri	8	11	00.10	00.29	+ 0.19	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1839, Oct. 28	☽'s 2d Limb	8	41	33.36			B
"	ι Urs. Maj.	8	48	12.79	13.00	+ 0.21	"
"	α Hydræ	9	19	42.88	42.93	+ 0.05	"
"	α Leonis	9	59	50.03	50.22	+ 0.19	"
29	6 Cancri	7	53	40.82	40.55	— 0.27	"
"	15 Argus	8	00	44.40	43.80	— 0.60	"
"	λ Cancri	8	11	00.63	00.33	— 0.30	"
"	ι Hydræ	8	38	18.18	17.84	— 0.34	"
"	ξ Cancri	9	00	08.53	08.64	+ 0.11	"
"	α Hydræ	9	19	42.85	42.96	+ 0.11	"
"	☽'s 2d Limb	9	34	34.08			"
"	ε Leonis	9	36	44.56	45.09	+ 0.53	"
"	α Leonis	9	59	49.96	50.25	+ 0.29	"
Nov. 12	α Aquilæ	19	42	57.81	57.82	+ 0.01	W
"	β Aquilæ	19	47	26.48	26.52	+ 0.04	"
"	α^2 Capricorni	20	09	09.76	09.73	— 0.03	"
"	☽'s 1st Limb	20	20	53.41			"
"	ψ Capricorni	20	36	36.55	36.55	0.00	"
"	η Capricorni	20	55	17.11	17.29	+ 0.18	"
"	61' Cygni	20	59	43.59	43.59	0.00	"
"	ζ Cygni	21	06	07.61	07.30	— 0.31	"
"	ι Pegasi	21	36	19.72	19.51	— 0.21	"
13	η Capricorni	20	55	17.01	17.28	+ 0.27	B
"	☽'s 1st Limb	21	13	56.43			"
"	ζ Capricorni	21	17	31.36	31.38	+ 0.02	"
"	γ Capricorni	21	31	13.11	13.05	— 0.06	"
"	α Aquarii	21	57	34.15	33.91	— 0.24	"
16	β Aquarii	21	23	07.87	07.69	— 0.18	W
"	ι Pegasi	21	36	19.49	19.46	— 0.03	"
"	Fomalhaut	22	48	48.49	48.25	— 0.24	"
"	α Pegasi	22	56	48.07	47.89	— 0.18	"
"	κ^1 Piscium	23	18	44.35	44.33	— 0.02	"
"	ι Piscium	23	31	43.79	43.67	— 0.12	"
"	☽'s 1st Limb	23	47	28.27			"
"	ω Piscium	23	51	06.55	06.32	— 0.23	"
"	α Andromedæ	0	00	07.96	08.11	+ 0.15	"
"	d Piscium	0	12	22.59	22.83	+ 0.24	"
18	α Andromedæ	0	00	08.58	08.11	— 0.47	B
"	γ Pegasi	0	05	00.85	00.79	— 0.06	"
"	α Cassiopeæ	0	31	28.32	28.50	+ 0.18	"
"	β Ceti	0	35	34.15	34.32	+ 0.17	"
"	☽'s 1st Limb	1	36	46.25			"
"	β Arietis	1	45	50.06	49.70	— 0.36	"
19	α Cassiopeæ	0	31	28.68	28.49	— 0.19	W
"	ϑ Ceti	1	16	02.90	02.81	— 0.09	"
"	β Arietis	1	45	49.61	49.70	+ 0.09	"
"	ϑ^1 Arietis	2	09	14.91	15.31	+ 0.40	"

Date.	Name of Object.	Sidereal Time of Meridian Passage. h.	m.	s.	Seconds of Tabular A. R. s.	Diff. s.	Observer's initial.
1839, Nov. 19	☽'s 1st Limb	2	37	40.99			W
"	ε Arietis	2	50	05.22	05.60	+ 0.38	"
"	α Ceti	2	53	56.23	56.48	+ 0.25	"
"	δ Arietis	3	02	30.14	30.43	+ 0.29	"
20	α Andromedæ	0	00	08.07	08.07	0.00	"
"	α Cassiopeæ	0	31	28.45	28.45	0.00	"
"	☽'s 1st Limb	3	43	40.76			"
21	A^1 Tauri	3	55	16.14	15.85	— 0.29	"
"	υ^1 Tauri	4	16	45.58	45.38	— 0.20	"
"	☽'s 2d Limb	4	56	14.76			"
"	β Tauri	5	16	12.00	12.23	+ 0.23	"
"	ι Aurigæ	5	28	23.78	23.02	— 0.76	"
22	A^1 Tauri	3	55	15.27	15.86	+ 0.59	B
"	υ^1 Tauri	4	16	45.61	45.39	— 0.22	"
"	α Tauri	4	26	46.13	46.00	— 0.13	"
"	β Tauri	5	16	11.94	12.25	+ 0.31	"
"	κ Aurigæ	6	05	12.58	12.25	— 0.33	"
"	☽'s 2d Limb	6	08	08.44			"
"	μ Geminorum	6	13	18.11	17.85	— 0.26	"
"	ε Geminorum	6	35	06.69	06.33	— 0.36	"
25	☽'s 2d Limb	9	14	40.57			"
"	λ Leonis	9	22	35.04	35.42	+ 0.38	"
"	ο Leonis	9	32	36.78	36.81	+ 0.03	"
"	ε Leonis	9	36	46.02	46.04	+ 0.02	"
"	γ Leonis	10	11	08.56	08.58	+ 0.02	"
28	χ Leonis	10	56	45.60	45.57	— 0.03	"
"	σ Leonis	11	12	52.70	52.72	+ 0.02	"
"	☽'s 2d Limb	11	38	38.00			"
Dec. 10	☽'s 1st Limb	20	57	06.94			W
"	Fomalhaut	22	53	47.97	47.92	— 0.05	"
"	α Pegasi	22	56	47.57	47.62	+ 0.05	"
"	α Andromedæ	0	00	07.86	07.84	— 0.02	"
"	α Arietis	1	58	10.84	10.83	— 0.01	B
11	☽'s 1st Limb	21	48	14.07			W
"	ζ Pegasi	22	33	28.77	28.77	0.00	"
"	α Aquarii	21	57	33.49	33.59	+ 0.10	"
"	α Pegasi	22	56	47.60	47.61	+ 0.01	"
13	ζ Pegasi	22	33	28.85	28.75	— 0.10	"
"	Fomalhaut	22	48	48.00	47.88	— 0.12	"
"	λ Aquarii	22	44	15.87	15.87	0.00	"
"	φ Aquarii	23	06	02.33	02.26	— 0.07	"
"	☽'s 1st Limb	23	27	11.47			"
"	ω Piscium	23	51	06.44	06.07	— 0.37	"
"	α Andromedæ	0	00	07.45	07.80	+ 0.35	"
"	γ Pegasi	0	05	00.48	00.56	+ 0.08	"
"	β Ceti	0	35	34.03	34.09	+ 0.06	"
14	☽'s 1st Limb	0	17	25.28			"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's Initial.
		h.	m.	s.	s.	s.	
1839, Dec. 14	α Cassiopeæ	0	31	27.99	27.99	0.00	W
"	β Ceti	0	35	34.08	34.08	0.00	"
"	δ Piscium	0	40	23.94	23.73	—0.21	"
17	α Aquarii	21	57	33.68	33.54	—0.14	"
"	Fomalhaut	22	48	48.14	47.83	—0.31	"
"	α Pegasi	22	56	47.65	47.54	—0.11	"
"	γ Pegasi	0	05	00.56	00.52	—0.04	"
"	β Ceti	0	35	33.80	34.05	+0.25	"
"	α Arietis	1	58	10.86	10.79	—0.07	"
"	γ Ceti	2	35	02.01	02.30	+0.29	"
"	ν Arietis	2	29	45.69	45.28	—0.41	"
"	π Arietis	2	40	23.83	23.63	—0.20	"
"	☽'s 1st Limb	3	08	18.45			"
"	g Arietis	3	14	53.56	53.43	—0.13	"
"	η Tauri	3	38	00.18	00.41	+0.23	"
18	β Ceti	0	35	34.01	34.04	+0.03	"
"	α Arietis	1	58	10.66	10.78	+0.12	"
"	γ Ceti	2	35	01.84	02.30	+0.46	"
"	α Ceti	2	53	56.57	56.54	—0.03	"
"	g Arietis	3	14	53.88	53.44	—0.44	"
"	η Tauri	3	38	00.21	00.41	+0.21	"
"	γ^1 Eridani	3	50	35.83	35.51	—0.32	"
"	☽'s 1st Limb	4	15	17.65			"
"	α Tauri	4	26	46.29	46.28	—0.01	"
20	α Tauri	4	26	46.80	46.29	—0.51	"
"	Rigel	5	06	52.84	52.67	—0.17	"
"	β Tauri	5	16	12.26	12.71	+0.45	"
"	δ Orionis	5	23	51.45	51.76	—0.31	"
"	ε Orionis	5	28	07.43	07.44	+0.01	"
"	c Tauri	5	43	17.83	18.18	+0.35	"
"	α Orionis	5	46	32.25	32.32	+0.07	"
"	κ Aurigæ	6	05	12.60	12.87	+0.27	"
"	☽'s 2d Limb	6	39	05.38			"
"	τ Geminorum	7	00	58.39	58.85	+0.46	"
"	δ Geminorum	7	10	35.33	35.55	+0.22	"
25	☽'s 2d Limb	11	25	13.18			B
"	β Virginis	11	42	22.38	22.38	0.00	"
"	η Virginis	12	11	43.71	43.74	+0.03	"
"	q Virginis	12	25	31.59	31.68	+0.09	"

Two hundred and ninety-fourth Meeting.

April 6, 1847. — MONTHLY MEETING.

The PRESIDENT in the chair.

Professor Strong, of New Brunswick, New Jersey, communicated the following papers, viz.: —

I. "*An attempt to prove that the sum of the three angles of any rectilineal triangle is equal to two right angles.*

"*Def.* Two quantities are said to be of the same kind, when the less can be multiplied by some positive integer, so as to exceed the greater. Thus, if A and B are quantities of the same kind, and if A is greater than B, then some positive integer, m, may be found, such that the inequality $m B > A$ shall exist. For if m is taken greater than the quotient arising from the division of A by B, then evidently there results the inequality $m B > A$, as required.

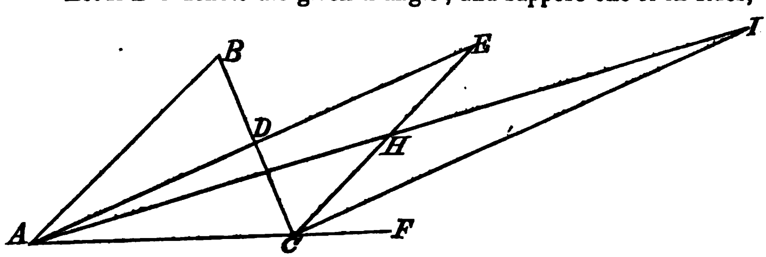
"*Dem.* If m denotes any positive integer, then shall the inequality $2^m > m$ obtain. For the first member of the inequality denotes the product arising from taking 2 as a factor as often as these units in m, whereas the second member is the sum of the units represented by m, and the inequality is evident.

"*Cor.* If we take A and B, as above, and $m B > A$, there results $B > \frac{A}{m}$; much more, then, shall the inequality $B > \frac{A}{2^m}$ have place. This follows at once since it has been shown that 2^m is greater than m; and it is evident that if m is an indefinitely great number, $\frac{A}{m}$ is indefinitely greater than $\frac{A}{2^m}$.

"*Ax.* No angle of a rectilineal triangle can exceed two right angles.

"*Prop.* 1. To find a triangle that shall have the sum of its angles equal to the sum of the angles of any given triangle.

"Let $A B C$ denote the given triangle; and suppose one of its sides,



$B C$, is bisected at D, and that D and the opposite angle A are connected by the right line $A D$, which is produced in the direction $A D$

to E, so that $DE = AD$, and that the point E and the angle C are connected by a right line; then shall the sum of the angles of the triangle $A\,C\,E$ equal that of the triangle $A\,B\,C$.

"For the opposite vertical angles $A\,D\,B$, $C\,D\,E$ are equal (Simson's Euclid, B. I., prop. 15), and by construction $BD = DC$, $AD = DE$; hence (Sim., B. I., p. 4) the triangles $A\,D\,B$, $C\,D\,E$ are identical; so that their bases $A\,B$, $C\,E$ are equal, and their angles $A\,B\,D$, $E\,C\,D$ are equal; also the angle $B\,A\,D$ equals the angle $C\,E\,D$. Hence the angle C of the triangle $A\,C\,E$ equals the sum of the two angles B and C of the given triangle ($A\,B\,C$), and the sum of the angles A and E of the triangle $A\,C\,E$ is equal to the angle A of the given triangle ($A\,B\,C$); $\therefore$ the sum of the angles of the triangle $A\,C\,E$ is equal to that of the given triangle $A\,B\,C$, as required.

"*Cor.* 1. Let the angle $B\,A\,C$ of the given triangle be denoted by A; then if $C\,E$ ($= A\,B$) is not greater than $A\,C$, the angle $C\,A\,E$ is not greater than $C\,E\,A$ (Sim., props. 5, 19, B. I.); hence the angle A of the triangle $A\,C\,E$ is not greater than $\frac{A}{2}$; we shall call the triangle $A\,C\,E$ the first derived triangle. Of the two sides $A\,C$ and $C\,E$ of the triangle $A\,C\,E$, let $C\,E$ be that which is not the greater; and let a right line be drawn from the angle A, opposite to the side $C\,E$, through the point, H, of bisection of $C\,E$, and suppose the line thus drawn to be produced in the direction $A\,H$ to I, so that $HI = HA$; then connect the point I and the angle C of the triangle $A\,C\,E$ by a right line; and there will be formed the triangle $A\,C\,I$. In the same way that it was shown that the sum of the angles of the triangle $A\,C\,E$ is equal to the sum of the angles of the (given) triangle $A\,B\,C$, it may be shown that the sum of the angles of the triangle $A\,C\,I$ is equal to that of $A\,C\,E$; consequently the sum of the angles of $A\,C\,I$ equals that of the given triangle $A\,B\,C$. And if $A\,C$ is not greater than $C\,I$, then it may be shown (as before) that the angle I is not greater than the angle $C\,A\,E \div 2$, and since $C\,A\,E$ is not greater than $\frac{A}{2}$, $\therefore$ the angle I is not greater than $\frac{A}{2^2}$, we shall call $A\,C\,I$ the second derived triangle.

"We may in the same way (that we derived the triangle $A\,C\,I$ from $A\,C\,E$) derive a triangle from $A\,C\,I$ (called the third derived triangle), having the sum of its angles equal to that of $A\,C\,I$, and of course equal to that of the given triangle $A\,B\,C$, and having one of its angles not greater than the angle $A\,I\,C \div 2$, and consequently not greater

than $\frac{A}{2^3}$. And proceeding in the same way from triangle to triangle, until we obtain the m^{th} derived triangle, then the sum of its angles will equal that of the given triangle $A\,B\,C$, and one of its angles will not be greater than $\frac{A}{2^m}$; where m is of course a positive integer.

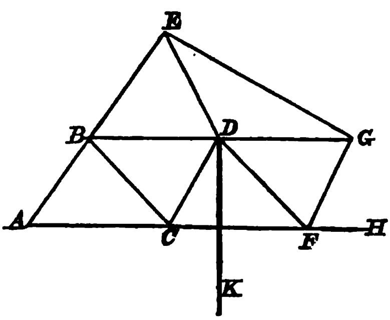
"*Cor.* 2. If we obtain the derived triangle whose number is $m+1$, the sum of two of its angles will equal that angle of the m^{th} triangle which has been shown not to be greater than $\frac{A}{2^m}$; we hence see how from any given triangle to derive another triangle such that the sum of its angles shall equal that of the given triangle, and such that the sum of two of its angles shall not be greater than $\frac{A}{2^m}$; where A denotes one of the angles of the given triangle.

"*Remark.* Cor. 1 is substantially the same as Mr. I. Ivory's process, given at page 189 of the New York edition of J. R. Young's *Elements of Geometry.*

"*Prop.* 2. The sum of the angles of any triangle is not greater than two right angles.

"Let the triangle $A\,B\,C$, of Prop. 1, represent any triangle, and denote a right angle by R, and if possible let the sum of the angles of the triangle equal $2\,A+V$, V being a finite positive angle. Then, using A to represent the angle $B\,A\,C$ of the triangle, some positive integer, m, may be found so that the inequality $m\,V>A$ shall exist. From $m\,V>A$, it follows that $V>\frac{A}{m}>\frac{A}{2^m}$, or V is greater than $\frac{A}{2^m}$. By Cor. 2, Prop. 1, we may derive a triangle from $A\,B\,C$, such that the sum of two of its angles shall not be greater than $\frac{A}{2^m}$; hence the sum of these two angles is less than V; consequently the third angle of the triangle must be greater than $2\,R$, which is impossible. Hence the sum of the angles of the triangle $A\,B\,C$ is not greater than two right angles.

"*Prop.* 3. The sum of the angles of any triangle is greater than a right angle.



"Let $A\,B\,C$ represent any triangle, and suppose (for convenience) that the angle $A\,B\,C$ is not less than either of the other angles of the triangle. Let the base be extended in the direction $A\,C$ to F, so that $C\,F$ equals the base ($A\,C$), and through C and F draw the right lines $C\,D$ and $F\,G$, each equal to $A\,B$, and so

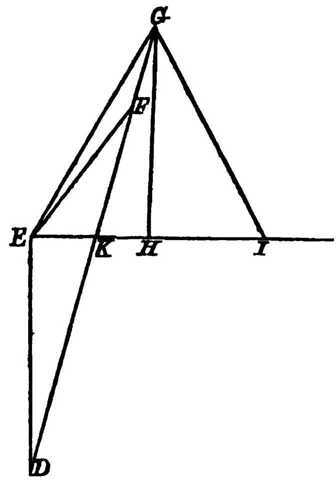
as to make the angles $D C F$, $G F H$ each equal to the angle $B A C$, and connect the points D and F, D and G, D and B, by right lines; also through D draw $D K$, at right angles to $D G$. Since $A B = D C$, $A C = C F$, and the angle $B A C$ equals the angle $D C F$, the triangles $A B C$, $C D F$ are identical (Sim., B. I., p. 4), making the sides $D F$ and $B C$ equal to each other, and the angle $C D F$ equal to the angle $A B C$, and the angle $C F D$ equal to the angle $A C B$; hence the sum of the angles $B A C$, $B C A$ equals the sum of the angles $B C A$, $D C F$, which equals the sum of the angles $C F D$, $G F H$. Since the sum of the three angles at C makes two right angles, and that the sum of the angles at F makes two right angles (Sim., B. I., p. 13), it follows from what has been proved that the angles $B C D$, $D F G$ are equal, and since $B C = D F$, $C D = F G$, the triangles $B C D$, $D F G$ are identical (Sim., B. I., p. 4), making $B D$ equal to $D G$, and the angle $C B D$ equal to the angle $F D G$, and the angle $C D B$ equal to the angle $F G D$; hence the sum of the angles $C B D$, $C D B$ equals the sum of the angles $C D B$, $F D G$. By Prop. 2, since the sum of the three angles of any triangle is not greater than two right angles, and that the three angles at C make two right angles, it follows that the sum of the angles B and D of the triangle $B C D$ is not greater than the sum of the angles $A C B$, $F C D$; hence, and from what has been proved, it follows that the sum of the angles of the triangle $A B C$ is not less than the sum of the angles $B D C$, $C D F$, $F D G$; but it is evident that the sum of these angles exceeds the right angle $K D G$ by a fine angle; hence the sum of the three angles of the triangle $A B C$ exceeds a right angle, as required.

"*Remark.* If $A B$ is extended in the direction $A B$ to E, so that $B E = B D$, and if the points D and E, G and E, are connected by right lines, the point D falls evidently within the pentagonal figure $C B E G F$; and if R denotes a right angle, the sum of the angles $B D C$, $C D F$, $F D G$, $G D E$, $E D B$ is equal to $4 R$ (Sim., B. I., p. 15, Cor. 2). Since the sum of the angles $A B D$, $D B E$ is equal to $2 R$, the sum of the angles at the base of the isosceles triangle $B D E$ is not greater than the angle $A B D$; consequently the angle $B D E$ is not greater than the angle $A B D \div 2$, which is not greater than half the sum of the angles $B D C$, $C D F$, $F D G$. We now observe that the sum of the angles of the triangle $A B C$ is not less than $R + \frac{5}{16} R$. For if the sum of the angles of the triangle $A B C$ is not greater than $R + \frac{5}{16} R$, then by what has been shown the sum of the angles $B D C$,

$C\,D\,F$, $F\,D\,G$, $B\,D\,E$ is not greater than $R + \frac{5}{16}R + \frac{R}{2} + \frac{5}{32}R = \frac{63}{32}R$; consequently the angle D of the triangle $E\,D\,G$ is not less than $4\,R - \frac{63}{32}R = \frac{65}{32}R = 2\,R + \frac{R}{32}$, which is impossible; hence the sum of the angles of any triangle, $A\,B\,C$, is greater than $R + \frac{5}{16}R$, as required.

"*Prop.* 4. The sum of the angles of any triangle is not less than two right angles.

"If the sum of the angles of any one triangle is not the same as that of any other, then there are evidently some triangles having the sum of their angles less than that of any others; let, therefore, $A\,B\,C$ (see fig., Prop. 1) denote a triangle such that the sum of its angles is not greater than that of any other triangle. If R represents a right angle, then, since the sum of the angles of any triangle is greater than R, the sum of the angles of the triangle $A\,B\,C$ may be expressed by $R + V$, V being a positive angle. If we denote the angle $B\,A\,C$ of the given triangle by A, then, as in Prop. 2, we may find some positive integer, m, such that the inequality $V > \frac{A}{2^m}$ shall have place; and by Cor. 1 and 2 of Prop. 1 we may derive from the triangle $A\,B\,C$ another triangle represented by $D\,E\,F$ such that the sum of its angles shall equal that of $A\,B\,C$, and consequently equal $R + V$, and further



such that the sum of two of its angles, $E\,D\,F$, $E\,F\,D$, shall not be greater than $\frac{A}{2^m}$; $\therefore$ the sum of these (two) angles is less than V, consequently the third angle E of the triangle is greater than R. Of the two sides $D\,E$, $E\,F$, let $D\,E$ be that which is not the less, and through E draw $E\,K$, at right angles to $D\,E$; then, since the angle $D\,E\,F$ is greater than R, the perpendicular will of course meet the side $D\,F$ at some point, as K, between D and F. Since the sum of the sides $D\,E$ and $E\,F$ is greater than $D\,F$ (Sim., p. 20, B. I.), and that $D\,K$ is greater than $D\,E$ (Sim., p. 19, B. I.), we of course have $D\,K$ greater than $K\,F$. Hence extend $D\,F$ to G, so that $G\,K = D\,K$, and extend $E\,K$ to H, so that $K\,H = E\,K$, and connect G and H

by a right line; also extend $E H$ to I, so that $I H = E H$, and draw a right line from I to G. Since $D K = G K$, $E K = H K$, and the angles $D K E$, $G K H$ are equal (Sim., Prop. 15, B. I.), the triangles $D K E$, $G K H$ are identical (Sim., p. 4, B. I.), and $D E = G H$, the angle $G H K =$ the angle $D E K = R$, and the angle $H G K =$ the angle $E D K$; hence the triangles $E H G$, $I H G$ are identical, since they have $E H = I H$, $H G$ common, and that the angles at H are right (Sim., p. 4, B. I.); hence the sides $G E$, $G I$ are equal, the angle $G I H$ equals the angle $G E H$, and the angle $I G H$ equals the angle $E G H$. Since the angle $D F E$ is greater than either of the angles $F G E$, $F E G$ (Sim., p. 16, B. I.), it follows from what has been shown that the angle $E G H$ is not greater than the sum of the angles $E D F$, $E F D$, and of course the sum of the angles $E G H$, $K E F$ is not greater than V, and since $G E F$ is less than $E F D$, $G E F$ is not greater than $\frac{A}{2^m}$, $\therefore$ the sum of the angles $E G H$, $H E G$ is not greater than $V + \frac{A}{2^m}$, consequently the sum of the angles of the triangle $E G I$ is not greater than $2 V + \frac{2 A}{2^m}$. But by hypothesis the sum of the angles of the triangle $A B C$, which equals the sum of the angles of the triangle $D E F$, is not greater than the sum of the angles of the triangle $E G I$; $\therefore 2 V + \frac{2 A}{2^m}$ is not less than $R + V$, or V is not less than $R - \frac{2 A}{2^m}$. Hence V cannot differ from R by any given angle, as a, so that $V = R - a$, a being a positive finite angle; for by taking a sufficiently great positive integer for m (which is evidently arbitrary), we shall make $\frac{2 A}{2^m}$ less than a, which is absurd; $\therefore V$ is not less than R. Hence the sum of the angles of the triangle $A B C$ is not less than $2 R$.

"*Cor.* Since by Prop. 2 the sum of the angles of any triangle is not greater than $2 R$, and from what has been shown in this Prop. it is not less than $2 R$, it follows that the sum of the angles of any triangle $= 2 R =$ two right angles, as required.

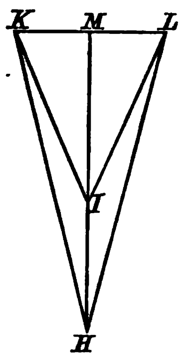
"*Appendix to Propositions* 3 *and* 4.

"*Lem.* No triangle can exist such that the sum of its angles shall be less than any given angle; or such that the sum of its angles shall equal an infinitesimal angle. For, if possible, let $A B C$ be such a triangle; then, since the sum of its angles is less than any given angle, each of its angles is of course less than

any given angle. Hence, since the angles C and B are infinitesimal angles, the sides $A\,C$ and $A\,B$ must coincide very nearly with the side $C\,B$, and $\therefore$ since $A\,C$ and $A\,B$ lie in opposite directions they cannot possibly come near to coincidence with each other; but since the angle A is less than any given angle (or infinitesimal), the sides $A\,C$, $A\,B$ must very nearly coincide with each other and have nearly the same direction, which is absurd. Hence the sum of the angles of a triangle is not less than any given angle (or infinitesimal), but it is a finite quantity, being equal to some finite angle, or the sum of finite angles.

"*Remark.* By aid of this lemma we are prepared to give a very simple demonstration of Prop. 3.

"*Prop. 3'.* The sum of the angles of any triangle is greater than a right angle. Let the triangle $A\,B\,C$, of Prop. 1, denote any triangle, and denote the angle $B\,A\,C$ by A, and use V to represent any small finite angle; then we may find some positive integer, m, such that the inequality $m\,\frac{V}{2} > A$ shall exist, consequently the inequality $\frac{V}{2} > \frac{A}{2^m}$ has place also. Hence, by Cor. 1 and 2 of Prop. 1, we can find a derived triangle, which we shall represent by the triangle $H\,I\,K$, such that the sum of its angles equals that of $A\,B\,C$, and the sum of two of its angles, $I\,H\,K$, $I\,K\,H$, is not greater than $\frac{A}{2^m}$, $\therefore$ $\frac{V}{2}$ is greater than the sum of these two angles. At the point I make the angle $H\,I\,L$, equal to the angle $H\,I\,K$;



also make the right line $I\,L$ equal to the side $I\,K$, and draw a right line from H to L; then (Sim., p. 4, B. I.) the triangles $H\,I\,K$, $H\,I\,L$ are identical, making the side $L\,H$ equal to the side $H\,K$, the angle $I\,H\,L$ equal to the angle $I\,H\,K$, and the angle $I\,L\,H$ equal to the angle $I\,K\,H$; hence V is greater than the sum of the four angles $I\,H\,K$, $I\,H\,L$, $I\,K\,H$, $I\,L\,H$. If we connect the points K and L by a right line, it will intersect $I\,H$, or $I\,H$ produced, in some point, M, and the angles at M will be right angles; for the triangles $K\,H\,M$, $L\,H\,M$ are identical, since $H\,K = H\,L$, and the side $H\,M$ common, and that the angle $K\,H\,M$ equals the angle $L\,H\,M$, $\therefore$ the angle $K\,M\,H$ equals the angle $L\,M\,H$ (Sim., p. 4, B. I.); consequently $K\,M$ is a perpendicular from the angle K of the triangle $H\,I\,K$ to the opposite side $H\,I$, or to $H\,I$ produced (Sim., def. 10, B. I.). We now observe that

KM must fall without the triangle HIK (or that it will meet HI, produced in the direction HI), for if KM does not fall without the triangle KIH, but coincides with KI, or falls at some point between H and I, then we shall have the triangle HKL such that the sum of its angles is less than V, and as V is any finite angle taken as small as we please, $\therefore$ the sum of the angles of the triangle HKL is less than any finite angle, or it is infinitesimal, which is impossible. Hence the perpendicular KM falls on HI produced in the direction HI, so as to make the angle HKM equal to some finite angle; and it is evident that the perpendicular cannot intersect HI produced in the direction IH, for if it could, a triangle would be formed having the sum of two of its angles greater than two right angles, which is impossible. Hence, since the angle HIK is the exterior angle of the triangle KIM, it is greater than the right angle KMI (Sim., p. 16, B. I.); hence the sum of the angles of any triangle is greater than a right angle, as required.

"*Prop.* 4′. The sum of the angles of any triangle is not less than two right angles.

"We shall use the figure to Prop. 3′. It is evident that we may suppose the sum of the angles of the triangle KHL not less than that of the triangle KIH, or, since the sum of the angles IHK, IKH is not greater than $\frac{A}{2^m}$, we shall have $2\,IKM + \frac{A}{2^m}$, not less than the angle KIH. Hence, if we denote a right angle by R, since the sum of the angles HIK, KIM is equal to $2R$ (Sim., p. 13, B. I.), and that the sum of the angles KIM, IKM is not greater than R (see our Prop. 2, and observe that the angle $IMK = R$), we get IKM not less than $R - \frac{A}{2^m}$, or $\frac{A}{2^m}$ is not less than the angle KIM. But $\frac{A}{2^m}$ is less than any given angle, $\therefore$ the angle KIM is infinitesimal, consequently the angle KIH differs from $2R$ by an infinitesimal angle, and of course the sum of the angles of the triangle KIH or ABC is not less than $2R$, as required.

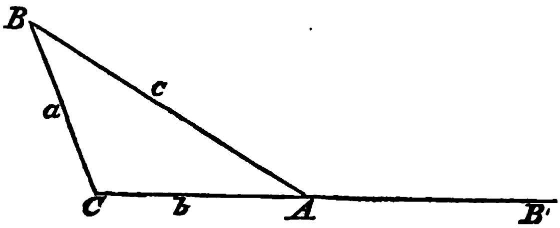
"*Cor.* Hence, since the sum of the angles of any triangle (ABC), is neither greater nor less than $2R$, it is equal to $2R$, = two right angles."

II. "*An attempt to show (analytically) that the sum of the angles of any rectilineal triangle is equal to two right angles.*

"*Ax.* The angle formed by two (right) lines is independent of the lengths of the lines.

"*Prop.* 1. To express any side of a triangle in terms of the other sides and their included angle.

"Let ABC be any triangle; and suppose its sides BC, AC, AB severally contain some assumed length (considered as the unit of



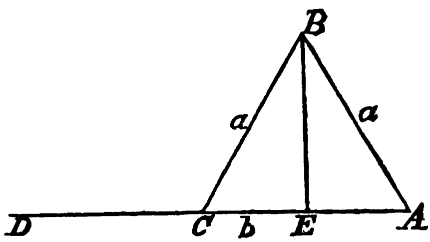
length) a, b, c times, then will the sides be expressed by a, b, c; where it may be observed that a, b, c are positive, and that they may be integral or fractional, rational or surd, according to the nature of the case; we shall denote the angle BAC by A, and shall suppose CA to be produced (in the direction CA) to B', so that $AB' = BA$, then (Simson's Euclid, Book I., prop. 13) the angle BAB' is the supplement of A, or the sum of A and BAB' is equal to two right angles.

"By Sim., B. I., p. 20, we have the inequalities $a + b > c$, $a + c > b$, or (which is equivalent to them), we have $a > \pm (c - b)$, (1); in which we must use the upper sign when c is greater than b, and the lower sign must be taken when c is less than b; and it is manifest that (1) exists even when $c = b$. In order to remove the ambiguous sign, we may (by taking the second power of a, and $\pm (c - b)$ put (1) under the form $a^2 > (c - b)^2$, or $a^2 - (c - b)^2 > 0$, (2). If the angle $A = 0$, AB falls on AC, and (2) evidently becomes $a^2 - (c - b)^2 = 0$, which is its least value; and, Sim., B. I., p. 24, if we suppose b and c each invariable, and the angle A to be increased, then A will be increased, and the greatest value that a can have will be when the angle A equals two right angles, or when AB coincides with AB', and $a = b + c$, so that (2) becomes $(b + c)^2 - (b - c)^2 = 4bc$, which is its greatest value; hence and by (2) if we put $\frac{a^2 - (c-b)^2}{2bc} = p$, (3), p cannot be less than 0 (or cannot be negative), nor greater than 2, or p has 0 for its lesser, and 2 for its greater limit. From (3) we get $a^2 = (c - b)^2 + 2pbc = b^2 + c^2 - 2(1 - p)bc$, or if we put $1 - p = n$, (4), then $a^2 = b^2 + c^2 - 2nbc$, (5); where, since p never passes the limits 0 and 2,

it is evident by (4) that n cannot pass the limits $+1$ and -1, and that n depends on the angle A; also that $n=1$ corresponds to $A=0$, and $n=-1$ to $A=$ two right angles; so that a is expressed in (5) as required.

"*Prop.* 2. To find the value of n, that corresponds to the base-angles of any isosceles triangle.

"Let ABC be any isosceles triangle; having $AB=CB=a$, for its sides, and $AC=b$ for its base, and let the base be produced in the direction AC to any point, D, then, Sim., B. I., p. 13, the angle BCD is the supplement of the angle BCA. Bisect the base



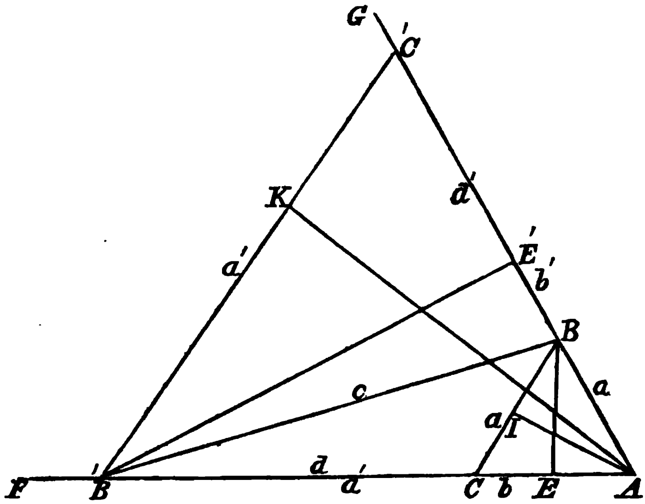
of the triangle in E, then draw the right line BE from the vertex B to E, and the triangles ABE, CBE are identical (Sim., B. I., pp. 8 and 4); so that the angle AEB equals the angle CEB, and these angles are right, Sim., B. I., def. 10, and BE is perpendicular to the base of the triangle. By (5) of prop. 1, we get $a^2 = a^2 + b^2 - 2nba$, or by reduc. $b = 2na$, or $n = \frac{\frac{b}{2}}{a} = \frac{AE}{AB} = \frac{CE}{CB}$, as required. Also, if we use m instead of n, for the vertical angle (B), we have $b^2 = a^2 + a^2 - 2maa = 2(1-m)a^2$, or $1-m = \frac{b^2}{2a^2}$, or since $b = 2na$, we get $\frac{b^2}{2a^2} = 2n^2$, $\therefore 2n^2 = 1-m$, or $n = \pm\sqrt{\frac{1-m}{2}}$, (1), which is another form of n; and it is manifest that if we take the upper sign before the radical for the value of n that corresponds to the acute angle BCA, we must take the lower sign before the radical in order to get the value of n that corresponds to the obtuse angle BCD, which (as before noticed) is the supplement of BCA ($= BAC$).

"*Cor.* 1. By what has been done it is evident, that, if we divide one of the legs of a right-angled triangle by the hypothenuse, we get the value of n that corresponds to the included angle; for evidently the same value of n corresponds to the isosceles triangle ABC, and to the identical right triangles into which it is divided by the perpendicular BE from its vertical angle.

"*Cor.* 2. It is manifest from (1), that all those isosceles triangles which have equal values of n for their base angles also have equal values of m for their vertical angles.

"*Prop.* 3. All right-angled triangles which have one of their acute angles common or equal will have equal values of n corresponding to the common or equal angles.

"Let $A B E$, $A B' E'$ be two right triangles, right-angled at E and E', and having the common angle A the hypothenuse of the one



and leg of the other (which include the common angle A) being in the right lines $A G$, $A F$, which include the angle A, that is common to the two triangles; that is, $A B$ and $A E'$ are in $A G$, $A B'$ and $A E$ in $A F$. When the angles are equal, but not common, we may imagine $A B E$ to be one of the triangles, and we may suppose the leg of the other triangle that is adjacent to the angle that is equal to A to be applied to $A G$, so that the angle which equals A shall coincide with A; then will the hypothenuse of the applied triangle lie on $A F$, and we may conceive that $A B' E'$ represents the applied triangle; so that the case of equal angles is reduced to that of a common angle. Let $E C = A E$ from E towards F, and $E' C' = A E'$ from E' towards G, then draw right lines from C to B, and from C' to B'; and it is evident by Sim., B. I., p. 4, that $A B C$, $A B' C'$ are isosceles triangles, $B E$, $B' E'$ being the perpendiculars from their vertical angles to their bases. Join the vertices of the isosceles triangles by the right line $B B' = c$, and put $A B = B C = a$, $A C = b$, $\frac{AE}{AB} = \frac{CE}{CB} = \frac{\frac{b}{2}}{a} = n$; also put $A B' = B' C' = a'$, $A C' = b'$,

$\frac{AE'}{AB'} = \frac{CE'}{CB'} = \frac{\frac{b'}{2}}{a'} = n'$; also let $CB' = d$, $CB = d'$. From the triangle ABB' we get, by prop. 1 (by using N, instead of n, to represent the angle A in this triangle, since n represents the angle A in the isosceles triangle ABC), $c^2 = a^2 + a'^2 - 2Naa'$, (1), or if we put $N = nx$, we get $c^2 = a^2 + a'^2 - 2nxaa'$; and in like manner we get from the triangle $B'BC$, $c^2 = a^2 + d^2 \pm 2nx'ad$, (2); where for $\pm$ we must use $+$ when B' is not between the points A and C, and $-$ must be used for $\pm$ when B' is between A and C, as is evident from (1) of prop. 2. Equating the two values of c^2, we get, after a slight reduction, $a'^2 - d^2 - 2nxaa' \mp 2nx'ad = 0$, (3); since $2na = AC$, and $a'^2 - d^2 = (a' + d)(a' - d) = (a' \pm d) \times AC$ (the upper sign being used when B' is not between A and C, and $-$ in the contrary case); hence, substituting the values of $2na$ and $a'^2 - d^2$, by rejecting the common factor AC, (3) is reduced to $a' \pm d - xa' \mp x'd = 0$, or $a'(1-x) \pm d(1-x') = 0$, or since $a' = b \pm d = AC \pm CB'$ (using the upper sign when B' is not between A and C, and $-$ when it is between A and C), we get $AC(1-x) \pm CB'(1-x+1-x') = 0$, (4). Now it is evident that CB' must be arbitrary, and not dependent on AC or $1-x$, $1-x'$; $\therefore$ we must have $1-x+1-x' = 0$, and (4) is reduced to $AC(1-x) = 0$, which, since AC is not $= 0$, gives $1-x = 0$, $\therefore$ $1-x' = 0$, or $x = 1$, $x' = 1$; hence (1) and (2) become $c^2 = a^2 + a'^2 - 2naa'$, (1'), $c^2 = a^2 + d^2 \pm 2nad$, (2'). In like manner, by regarding the angle A as belonging to the isosceles triangle $AB'C'$, we get from the triangles ABB', BCB', $c^2 = a^2 + a'^2 - 2n'aa'$, (1''), $c^2 = a'^2 + d'^2 \pm 2n'a'd'$, (2''); where for $\pm$ we must use $-$ when B is between A and C', and $+$ when B is in AC' produced beyond C'. By equating the values of c^2, as given by (1') and (1''), we get $n' = n$, or $\frac{AE'}{AB'} = \frac{AE}{AB}$, as was to be proved. It is evident that ABE may represent any right triangle having A for one of its acute angles, and its hypothenuse on AG; also $AB'E'$ may denote any right triangle which has A for one of its acute angles, and its hypothenuse on AF; hence, from what has been shown, n will be the same for all the triangles represented by ABE and $AB'E'$; that is, all right triangles which have a common or equal acute angle will have equal values of n corresponding to the common or equal acute angle. There is one case that apparently forms an exception to what has been shown; and that is when the hypothenuse of a tri-

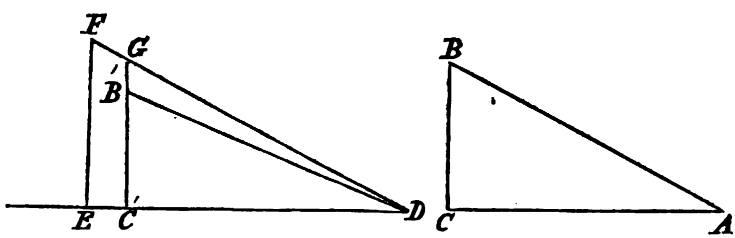
angle that lies in one of the lines AF, AG coincides with the leg of another triangle that lies in the other of these two lines; but this exception is only apparent, for the value of n in these two triangles is the same as that of n in the two triangles ABE, $AB'E'$, $\therefore$ when the hypothenuse of one triangle coincides with a leg of another triangle, the value of n, that corresponds to A in one of the triangles, is the same as in the other triangle.

"*Cor.* We can now easily find the value of m that corresponds to the vertical angle of an isosceles triangle whose base-angles are represented by n (or to which n corresponds).

"For let AI be drawn from the base-angle A of the isosceles triangle ABC, perpendicular to the opposite side BC, meeting it in I, then from what has been shown we get $CI = nb$, or (since $b = 2na$) $CI = 2n^2a$, $\therefore BI = a - CI = a(1 - 2n^2)$, and (since by (1) of prop. 2, $m = 1 - 2n^2$) we get $m = \frac{BI}{a} = \frac{BI}{AB}$, which can also be easily obtained from other considerations. And since n corresponds equally to the base-angles of all the isosceles triangles represented by ABC, $AB'C'$, and since $m = 1 - 2n^2$, it follows that all isosceles triangles whose base-angles are equal will have equal values of m corresponding to their vertical angles.

"*Prop.* 4. If there are two right-angled triangles, such that a leg of the one divided by its hypothenuse gives the same quotient as a leg of the other divided by its hypothenuse, then shall the angle included by the leg and hypothenuse of the one triangle be equal to the angle included by the leg and hypothenuse of the other triangle.

"Let ABC, DFE be two triangles right-angled at C and E, such that $\frac{AC}{AB} = \frac{DE}{DF} = n$; then shall the angle BAC equal the angle



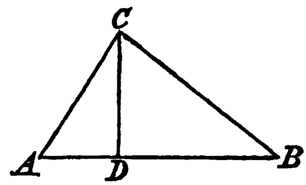
FDE. For on the longer leg DE of the one take DC' equal to AC, and through C' draw $C'G$ perpendicular to DE, meeting DF in G, then shall the triangles ABC, DGC' be identical; for since the right triangles DFE, DGC' have the angle D common, we

have, by prop. 3, $\frac{DC'}{DG} = \frac{DE}{DF} = n$, $\therefore$ $\frac{DC'}{DG} = \frac{AC}{AB}$, and since $D\,C' = A\,C$, we get $D\,G = A\,B$. If we take $C'B' = CB$, and draw a right line from D to B', the triangles $A\,B\,C$, $D\,B'C'$ are identical, Sim., B. I., p. 4, $\therefore$ $D\,B' = A\,B$, and of course $D\,B' = D\,G$, which cannot be unless B' falls on G; for of the base-angles $D\,B'G$, $D\,G\,B'$, one is acute and the other obtuse, and the same holds true whether B' is within or without the triangle $D\,F\,E$; hence we cannot have $D\,B' = D\,G$ unless B' coincides with G, Sim., B. I., p. 19. Hence, since the triangles $A\,B\,C$, $D\,B'C'$ are identical, and that B' falls on G, the triangles $A\,B\,C$, $D\,G\,C'$ are identical, and the angles $B\,A\,C$, $F\,D\,E$ are equal, as required.

"*Cor.* If we draw $A\,K$ at right angles to $B'C'$, meeting it in K (see fig., prop. 3), then since the base-angles of the isosceles triangles represented by $A\,B\,C$, $A\,B'C'$ are equal, we have, by cor. to prop. 3, $m = \frac{BI}{AB} = \frac{B'K}{AB'}$, and hence the vertical angles of the isosceles triangles are equal; and the same holds true whether the perpendiculars $A\,I$, $A\,K$ fall within the triangles (as in the figure) or without them; for when the perpendiculars fall without the triangles, the equality $\frac{BI}{AB} = \frac{B'K}{AB'}$ shows that the supplements of the vertical angles of the triangles are equal, and consequently the vertical angles are equal; and it is evident, by cor. to prop. 3, that the perpendiculars will both at the same time fall within or without the triangles; the case when $m = 0$, or $B\,I = 0$, $B'K = 0$, is too evident to require any explanation, for the vertical angles are evidently right. Hence the angles $A\,B\,E$, $A\,B'E'$, the halves of the vertical angles of the isosceles triangles, are equal; *hence it follows that all those right-angled triangles which have an acute angle common, or equal, have their other acute angles also equal.* Hence (see fig. 3) from the right triangles $A\,B\,E$, $A\,B'E'$, having their angles B, B' equal, we get $\frac{BE}{AB} = \frac{B'E'}{AB'}$, and since $\frac{AE}{AB} = \frac{AE'}{AB'}$ we deduce $\frac{BE}{AE} = \frac{B'E'}{AE'}$; that is, if we have two (or more) right triangles which have an acute angle common or equal, then if we divide the leg of any one of them which is opposite to the (equal) angle by the leg adjacent to the angle, the quotient will equal the corresponding quotient obtained in like manner from any other (one) of the triangles; and the converse of what is here affirmed is also easily proved to be true in a manner very analogous to that given in proving the proposition above.

"*Prop.* 5. The sum of the acute angles of a right triangle equals a right angle, and the sum of the squares of the legs equals the square of the hypothenuse.

"Let $A\,C\,B$ be the triangle, having the angle C right; from C draw $C\,D$, at right angles to the hypothenuse, meeting it at D; hence cor., prop. 4, since the right triangles $A\,C\,D$, $A\,C\,B$ have the angle A common, their other acute angles $A\,C\,D$ and B are equal; also since the (right) triangles $B\,C\,D$,

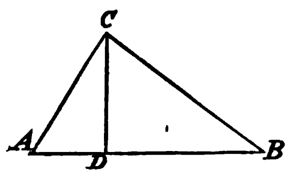


$A\,B\,C$ have a common angle, B, their other acute angles $B\,C\,D$ and A are equal. Hence the sum of the angles A and B is equal to the sum of the angles $B\,C\,D$ and $A\,C\,D$, which compose the right angle $A\,C\,B$, and of course the sum of the angles A and B is equal to a right angle; and consequently the sum of all the angles of the triangle $A\,C\,B$ is equal to two right angles. Again, the right triangles $A\,C\,B$, $A\,C\,D$ having the common angle A, by prop. 3, give the equality $\frac{AC}{AB} = \frac{AD}{AC}$, or $A\,C^2 = A\,B\,.\,A\,D$; and in the same way we get from the triangles $A\,C\,B$, $B\,C\,D$, $B\,C^2 = A\,B\,.\,B\,D$; and consequently $A\,C^2 + B\,C^2 = A\,B^2$, as required.

"*Cor.* Since the right triangles $A\,C\,D$, $B\,C\,D$ have the angles $C\,A\,D$, $B\,C\,D$ equal, they (by the cor. to prop. 4) give the equality $\frac{CD}{AD} = \frac{BD}{CD}$, or $C\,D^2 = A\,D\,.\,B\,D$.

"*Prop.* 6. The sum of the angles of any triangle is equal to two right angles.

"Let $A\,C\,B$ denote any triangle; and suppose that the angle C is not less than either of the other angles of the triangle, and that the perpendicular $C\,D$ is drawn from C to the opposite side $A\,B$; then, Sim., p. 17, B. I., $C\,D$ will fall within the triangle $A\,C\,B$. Hence, since the triangles $A\,C\,D$, $B\,C\,D$



are right-angled at D, by the last prop. the sum of the acute angles A and $A\,C\,D$ of the first of these triangles is equal to a right angle; and in the same way the sum of the acute angles B and $B\,C\,D$ of the second triangle is equal to a right angle; but the sum of the acute angles of these triangles equals the sum of the angles of the triangle $A\,C\,B$; consequently, the sum of the angles of the triangle $A\,C\,B$ is equal to two right angles, as required.

"In conclusion, we will remark that the relation of what has been

done to the doctrine of similar triangles and the science of trigonometry is too evident to require any comment."

Two hundred and ninety-fifth Meeting.

May 4, 1847. — Monthly Meeting.

The Vice-President in the chair.

Professor Peirce announced that he had continued and nearly completed his researches into the irregularities of motion exhibited by Uranus, and was more strongly than ever of the opinion that they were not to be attributed to the influence of the newly discovered planet Neptune. He had obtained several possible solutions of the problem, which are different from those of Leverrier and Adams, and which are published in a communication to the *Boston Courier*, dated April 29, 1847, and which he now proposes to lay before the Academy.

"The problem of the perturbations of Uranus admits of three solutions, which are decidedly different from each other, and from those of Leverrier and Adams, and equally complete with theirs. The present place of the theoretical planet, which might have caused the observed irregularities in the motions of Uranus, would, in two of them, be about *one hundred and twenty degrees* from that of Neptune, the one being behind, and the other before, this planet. If the above geometers had fallen upon either of these solutions instead of that which was obtained, Neptune would not have been discovered in consequence of geometrical prediction. The following are the approximate elements for the three solutions at the epoch of Jan. 1, 1847.

	I.	II.	III.
Mean Longitude, ...	319°	79°	199°
Longitude of Perihelion, . . .	148	219	188
Eccentricity, ...	0.12	0.07	0.16

In each of them (the mass of the sun being unity)

The mass is	0.0001187

"The period of sidereal revolution is double that of Uranus. It will be observed that the mean distance in all these cases is the same with that of Neptune, and that, in the first* of them, the present direction

* The first of these solutions is corrected from the one which was published in

is not more than seven degrees from it; and in another solution which I have obtained, the present direction is almost identical with Neptune's. But the coincidence fails in a most important point; for, whereas Walker and Adams both demonstrate, from incontrovertible data and a simple but indisputable argument, that the new planet cannot be more than ninety degrees from its perihelion, either of these two latter geometrical planets would now be in aphelion and at much too great a distance from the sun.

"All my attempts to reconcile the observed motions of Neptune with the assumption that it is the principal source of the unexplained irregularities in the motions of Uranus, have been frustrated. Whatever orbit is attributed to this planet in my analysis, whether Walker's, or Valtz's, or Encke's, or Adams's, or any other which I can suppose, and which is not unquestionably irreconcilable with observation, and whatever may be supposed to be its mass, I cannot materially diminish the amount of residual perturbation, but leave it full as great as it was previously to Galle's discovery. Notwithstanding my repeated examinations, it would be presumptuous in me to claim for my investigations a freedom from error which the greatest geometers have not escaped, especially in the face of the vastly improbable conclusion to which my analysis tends; namely, that the influence of the new planet is wholly different from that demanded by the problem whose solution led to its discovery. It may, however, be asked whether the attraction of Uranus might not be exhibited in the motions of Neptune, in such a way as to modify the orbit deduced from observation, and thus reconcile it with theory; but this question cannot be answered without further investigation."

Professor Peirce stated that the above solutions were not to be regarded as actual solutions, but merely as theoretical and possible; that is, if a planet had moved in either of the above orbits, the perturbations which it would have produced in Uranus would have been precisely those which have been manifested. But the influence of the planet Neptune has been wholly disregarded in obtaining these solutions, precisely because the nature of that influence must remain unknown,

a previous communication to the Boston Courier, and which was vitiated by an oversight in the date for which the computations had been made.

until the mass and orbit of this planet have been determined with accuracy. Mr. Sears C. Walker, of Washington, is actively engaged in computing the orbit of Neptune, and has sent an account of his results in a letter, from which the following is an extract.

"*Washington, D. C., May 3d*, 1847.

"After computing my Elements IV. of the planet Neptune, I compared with an ephemeris derived from them one hundred and thirteen American and three hundred and sixty-six European observations, being the entire series extant to this date.

"From this collection of observations I have derived thirteen normal places, which gave me thirteen conditional equations for correcting Elements IV., which were a slight modification of Elements II. of my former letter.

"In computing the conditional equations I used the method sketched out in my former letter. As this application of the method of mechanical quadratures to the formation of conditional equations for correcting an approximate orbit is new, I will give a brief statement of it. The conditional equation is,

$$0 = a x + b y + c z + d u + e v + \text{\&c.} + n.$$

Where $a = (t - 1846 \text{ years, } 340 \text{ days}).$

$b = 1.$

$c = \left(\frac{d\,\omega}{d\,r}\right).$

$d = \left(a c - \frac{2 n_0}{r_0} A^{(a)}\right).$

$e = \left(a^2 c - \frac{2 n_0}{r_0} B^{(a)}\right).$

Numerical term ... $n = \left(\omega_{,}^{(a)} - \omega'^{(a)}\right)$ = (*computed* — *observed*) true orbital longitude.

Also, n_0 = the assumed true daily sidereal angular motion for $a = 0$.

ω_0 = the assumed true orbital longitude for $a = 0$.

r_0 = the assumed radius vector . . . for $a = 0$.

x, y, and $z = \Delta n_0, \Delta \omega_0$, and Δr_0 = the required corrections for $a = 0$.

$\omega'^{(a)}$ = value of ω, from normal place, for date t, using $r = r_0$.

$\omega_{,}^{(a)} = \omega_0 + a\, n_0.$

$r^{(a)} = r_0 + z + a u + a^2 v + \text{\&c.}$ = corrected radius vector for date t.

$K^2 = (r_0 + z)^2 (n_0 + x) =$ Neptune's daily area.

$n^{(a)} = K^2 (r^{(a)})^{-2} =$ value of n for date t for conservation of areas.

$A^{(t)}, B^{(t)}$, &c. = the part of the coefficients of u, v, introduced by the quadratures.

"These coefficients were computed from Laplace's formula (*Mec. Cel.*, Vol. V.), viz. : —

$$\int_{a=0}^{a=a} n\,dt = +\tfrac{1}{2}n^{(0)} + n^{(1)} + n^{(2)} + \text{\&c.} + n^{(a-1)} + \tfrac{1}{2}n^{(a)}$$
$$-\tfrac{1}{12}(\Delta n^{(a-1)} - \Delta n^{(0)})$$
$$-\tfrac{1}{24}(\Delta^2 n^{(a-2)} - \Delta^2 n^{(0)})$$
$$-\tfrac{19}{72}(\Delta^3 n^{(a-3)} - \Delta^3 n^{(0)})$$
$$-\tfrac{3}{160}(\Delta^4 m^{(a-4)} - \Delta^4 m^{(0)})$$
$$-\text{\&c.}$$

"The solution of the thirteen equations of condition by least squares gave for Elements V., —

Longitude of the Perihelion, $\pi =$ 1° 45′ 32″.90 m. eq. Jan. 1, 1841.
Ascending Node, . . . ☊ = 129° 51′ 13″.53
Inclination, ... $\iota =$ 1° 45′ 38″.10
Eccentricity, ... $e =$ 0.00505292
Mean distance, . . . $a =$ 30.145119
Epoch, Jan. 1st, 1847, . $M =$ 326° 2′ 1″.34 .... for mean noon at
Mean daily sidereal motion, $\mu =$ 21″.437843 [Greenwich.
Period in tropical years, $T =$ 165.51330.

"The ephemeris from Elements V. in order to agree with the thirteen normal places requires the following corrections of the geocentric longitude and latitude.

Date.	Observation — Theory $\Delta\alpha$.	Observation — Theory $\Delta\delta$.
1846, Aug. 9,	− 0″.22	− 0″.72
Sept. 28,	+ 0.08	+ 0.37
Oct. 8,	+ 0.17	+ 0.28
18,	− 0.06	+ 0.09
28,	− 0.20	+ 0.71
Nov. 7,	− 0.13	− 0.42
17,	+ 0.25	− 0.27
27,	− 0.25	− 0.05
Dec. 7,	− 0.49	− 0.08
17,	+ 0.29	+ 0.25
27,	+ 0.14	+ 0.83
1847, Jan. 16,	+ 0.35	− 0.93
April 6,	− 0.10	+ 0.65

"I do not recollect a closer agreement of an orbit with actual observation. Accordingly I regard Elements V. as the present disturbed elements of Neptune.

"You will notice that the values of e and π came out nearly the same as those of Elements III., required by the hypothesis of identity of the planet and missing star of the *Histoire Céleste*, May 10th, 1795. The node and inclination are so connected together at present that (very nearly) ten times the increase of the latter applied to the former leaves the geocentric place unchanged.

"Let us make the hypothetical Elements VI. by applying to (V.) the corrections $\Delta \Omega = + 8''.50$, and $\Delta i = + 84''.8$, and let us suppose that the term $\frac{1}{t} \Sigma \delta \, (n\, t)$ has increased $0''.03422$ in the last fifty-two years; then Elements VI. will represent the last nine months' observations, and place the star and planet together May 10th, 1795.

"I am engaged in computing the constant coefficients for the perturbations of Neptune on your hypothesis of $(2\, n^{\mathrm{VII.}} - n^{\mathrm{VI.}}) = 0$, or in other words of the applicability of the Laplacian libration first pointed out by yourself. As far as I am at present informed, the near approach of this expression to 0 was first noticed by ourselves, on the occasion of your visit to Washington, on the 25th of February last.

"A glance at the configurations of the planets for the last two or three years would serve to indicate that while Saturn and Uranus are still increasing the term $\frac{1}{t} \Sigma \delta \, (n\, t)$, Jupiter has produced a tide (if I may use the phrase) which has not yet subsided, and which, added to the action of the other two, may have increased the disturbed daily motion $0''.32$ above the pure elliptic value. In this case, your period is established.

"Both hypotheses, that of the identity of the star and planet, and of the libration of Neptune's year round the double of that of Uranus, are now rendered so probable by conclusions from direct observations, that nothing but a rigorous computation of the perturbations of Neptune can throw any farther light on the subject at present. I shall look with anxiety for the publication of your researches on this subject.

"Yours truly,

"SEARS C. WALKER."

After reading this letter, Professor Peirce remarked that Mr. Walker's discovery of the identity of Neptune and the star of Lalande was indisputably confirmed by an examination which Mr. Mauvais of the Paris Observatory had made into the orig-

inal manuscripts of Lalande, at the request of Leverrier. He had found that the doubtful marks of the printed copy were not contained in the original record; and that there was an observation of the planet of May 8, 1795, which was not published. More than fifty years ago, then, Lalande had in his possession observations enough of Neptune to have discovered it; and he could not have failed to make this discovery if he had taken reasonable pains to satisfy himself as to the discrepant character of the observations by a new comparison with the stars.

Professor Peirce stated that he had compared the observation of May 8, 1795, with Mr. Walker's orbit, and found it to be perfectly consistent with the slight changes which are required to satisfy the observation of May 10, 1795. Mr. Walker's orbit cannot, therefore, differ much from the exact orbit, and there can be no important error in adopting it as the basis of further research. The period is very near the double period of Uranus, but yet it seems to differ too much from this double period to admit of the establishment of a libration about that period. The principal effect of Neptune upon Uranus must, in case of the failure of this double period, be exhibited in the manifestation of an equation of the centre different from that which belongs to the proper elliptic motion, so that Uranus will have two equations of the centre, one of which will belong to its ellipse, and the other to the attraction of Neptune.

James D. Dana, Esq., Corresponding Member of the Academy, presented (through the Corresponding Secretary) a paper comprising brief characters of the Crustaceæ collected in the United States Exploring Expedition under Captain Wilkes, as follows: —

Conspectus Crustaceorum, in orbis terrarum circumnavigatione, C. Wilkes e classe Reipublicæ Fœderatæ duce, collectorum auctore J. D. DANA.*

* Conspectus narrationis uberioris auctore auctoritate publicâ edendæ.

Pars I. — CRUSTACEA COPEPODA (CYCLOPACEA*).

Familia I. CYCLOPIDÆ.

Oculi duo simplices tantum. *Palpi* mandibulorum maxillarumque breves aut obsoleti. *Sacculi ovigeri* duo.

Genus I. CYCLOPS.

Antennæ maris anticæ subcheliformes aut articulo geniculante instructæ.

1. Cyclops Brasiliensis. — C. cephalo-thorace posticè obtuso, abdominem longitudine superante; antennis anticis in utroque sexu elongatis (cephalo-thorace longioribus), articulis primo secundoque majoribus et setis oblongis apice instructis, setis antennarum aliis brevibus; anntennis *maris* 7-articulatis, articulis tribus basalibus crassissimis, reliquis teretibus, *feminæ*, 14-articulatis, teretibus; stylis caudalibus

* Cyclopaceorum organa sunt: —

Cephalo-thorax 4 – 7-articulatus. *Abdomen* 1 – 6-articulatum, carapace non tectum.

Frons sæpissimè rostrata, rostro aut simplice, aut furcato, aut transversim emarginato, aut appendicibus instructo.

Oculi duo simplices, pigmento aut connati aut disjuncti; quoque quibusdam, oculi duo coaliti sub capite insistentes; aliis, oculi lenticulis duobus grandibus, uno oblato, uno prolato, constructi.

Antennæ anticæ 4 – 28-articulatæ, aut simplices, aut appendiculatæ; *posticæ*, 2 – 5-articulatæ et sæpe ramum ferentes, aliis apice setigeræ, aliis subcheliformes.

Mandibulæ apice dentatæ, sæpius palpigeræ.

Maxillæ duæ setosæ; sæpe palpigeræ, palpo sive parvulo et vix discernendo, sive setas diffusas ferente

Maxillipedes duo, aliis parvi et parcius setigeri, aliis crassiores et valde setigeri, setis spinulosis.

Pedes antici duo simplices, aut obsolescentes, aut elongati, aliis setigeri setis non spinulosis, aliis subcheliformes.

Pedes biremes decem; octo anteriores sæpius natatorii, sed duo antici interdum subprehensiles; duo posteriores plurimum obsoleti aut parvuli; in quibusdam masculinis pergrandes et uno ambove prehensiles.

Abdomini pertinentes ad basin sæpissimè *pedes spurii*, sive obsolescentes, sive oblongi et setis armati; ad extremum, styli caudales duo, unusquisque 4 – 6 setis plerumque plumosis instructus.

Ad segmentum cephalo-thoracis *septem*-articulati primum, antennæ quatuor pertinent; ad secundum, mandibula, maxillæ, et maxillipedes; ad tertium, pedes quatuor antici; (cephalo-thorace *quadri*-articulato, hæc tota ad segmentum anticum pertinent;) ad segmenta sequentia, singulatim, duo pedes biremes.

oblongis, tres articulos abdominis ultimos simul sumtos fere æquantibus, setâ secundâ * fere abdominis longitudine, primâ dimidio breviore.

Hab. Rio Janeiro.

2. CYCLOPS CURTICAUDUS. — C. *feminæ* cephalo-thorace posticè obtuso, abdominem longitudine valde superante; antennis anticis dimidio cephalo-thorace valde longioribus, 13 – 14-articulatis, articulis brevibus, quinque basalibus non oblongis; setis antennarum † inæqualibus, *posterioribus* articulorum penultimi et præantepenultimi longioribus (quatuor articulos ultimos simul sumtos longitudine æquantibus), *anterioribus* perbrevibus; stylis caudalibus prælongis, dimidio abdomine vix brevioribus, setis curtis, secundâ tertiâque subæquis et stylo paulo longioribus.

Long. $\frac{1}{20}''$. — *Hab.* Valparaiso, Chile.

3. CYCLOPS PUBESCENS. — C. cephalo-thorace pubescente, abdominem longitudine vix superante, posticè subacuto; antennis anticis *feminæ* dimidii cephalo-thoracis longitudine, 8 – 9-articulatis, setis totis brevibus; antennis *maris* brevioribus, tribus articulis basalibus curtis, quarto crassissimo subovato, dimidii antennæ longitudine, ultimo (forsan duplice) tenui brevique, digitiformi; stylis caudalibus abdomine quadruplo brevioribus, setâ secundâ abdomine longiore, primâ brevissimâ.

Long. $\frac{1}{24}''$. — *Hab.* Valparaiso, Chile.

4. CYCLOPS MACLEAYI. — C. *feminæ* cephalo-thorace abdomine valde longiore; antennis anticis longis (cephalo-thoracem æquantibus), ad basin paulo crassioribus, articulo secundo oblongo, 5 – 6 sequentes brevissimos simul sumtos longitudine fere æquante, 10 reliquis paulum oblongis, septimo longiore, setis articuli secundi et septimi parum elongatis, duorum subultimorum † totis brevibus, ultimi articulum longitudine vix superantibus; stylis caudalibus tenuibus, duos articulos abdominis longitudine æquantibus, setâ secundâ abdomine breviore, primâ fere styli longitudine.

Long. $\frac{1}{24}''$. — *Hab.* in vicin. Sydney, N. S. W.

* Setarum caudalium interior est nobis *prima*, et sequentes ordine, *secunda*, *tertia*, et cet.

† Setæ antennarum plerumque valent ad species distinguendum, et præcipuè illæ articulorum ultimorum. Articulos 2, 3, aut 4, ultimum præcedentes, *subultimos* sæpe vocamus; et eorum setæ, *anteriores* et *posteriores*, scrutandæ et comparandæ.

5. Cyclops Vitiensis. — C. *femina* cephalo-thorace posticè fere obtuso, abdominem longitudine vix superante, nudo; antennis anticis longis, cephalo-thoracis longitudine, multi-articulatis, articulo primo crasso, oblongo, secundo dimidio minore, 6 sequentibus perbrevibus; setis antennarum inæqualibus, articulorum primi secundique paulo longioribus, ultimi et 3 subultimorum posterioribus subæqualibus, articulo suoque paulo longioribus, setis anterioribus subultimorum perbrevibus; stylis oblongis, vix duorum articulorum abdominis longitudine, setâ secundâ abdomine paulo longiore.

Long. $\frac{1}{24}''$. — *Hab.* in Venua Lebu, ad Insulas Viti.

Familia II. — HARPACTIDÆ.

Oculi duo simplices tantum. *Palpi* mandibulorum maxillarumque parvuli, aut obsoleti, setis diffusis non instructi. *Sacculus ovigerus* unicus. *Antennæ posticæ* setis habitu digitorum apicè instructæ.

Genus I. HARPACTICUS. *Milne Edwards.*

Frons subrostrata, appendicibus nullis. *Antennæ anticæ maris* subcheliformes, aut articulo geniculante instructæ; *feminæ* basi 2–5 articulatâ et quasi curto flagello sæpius minutè 5-articulato compositæ, apice basis appendicem brevem ferentes. *Cephalo-thorax* 4-articulatus. *Pedes antici* subcheliformes mediocres.

Syn. — Arpacticus, et Cyclopsina partim (C. castor, excluso), *M. Edwards.* — Nauplius, *Philippi.* — Canthocarpus, *Westwood.* — Doris, *Koch.* — Canthocarpus et Arpacticus, non Cyclopsina, *Baird.*

1. Harpacticus virescens. — H. cephalo-thorace ovato, anticè rotundato et breviter rostrato, segmentis posticè non acutis, abdomine paululum subito angustiore et posticè sensim decrescente, 5-articulato; antennis anticis brevibus, dimidii cephalo-thoracis longitudine, 9-articulatis, articulis basalibus quatuor, crassiusculis, secundo maximo, setis perbrevibus; pedibus anticis parvis, digito dimidii articuli secundi longitudine; stylis caudalibus brevissimis, paulum divaricatis, setâ secundâ corporis longitudine, primâ tertiâque subæquis abdomine valde brevioribus.

Long. $\frac{1}{20}''$. — *Hab.* Madeira, in litora insulæ.

2. Harpacticus concinnus. — H. *femina* cephalo-thorace longè ovato, segmentis posticè acutis; abdomine subito paulum angustiore, lato, lateribus bene recto, 6-articulato, parce decrescente, articulo

primo brevissimo; antennis anticis brevibus, 9-articulatis, articulis basalibus quatuor, attenuatis, setis brevibus, apice paulum longis (flagellum longitudine æquantibus); pedibus anticis parvis, articulo secundo infra obtuso-angulato et digitum longitudine duplo superante; stylis caudalibus brevissimis, parum divaricatis, setâ secundâ corpore paulum breviore, tertiâ fere dimidio minore, reliquis brevissimis.

Long. $\frac{1}{20}''$. — *Hab.* in mare Pacifico prope Valparaiso.

3. Harpacticus sacer. — H. cephalo-thorace ovato, anticè subdeltoideo, segmentis posticè obtuso, dimidio longitudine latiore; abdomine subito multo angustiore, et breviore quam cephalo-thorax, 6-articulato, articulo primo brevi; antennis anticis brevibus, *feminæ* 9-articulatis, articulis basalibus quatuor, setis totis brevibus, *maris* articulo quinto (6?) crassissimo, subovato, margine anteriore subrecto, digito 2-articulato duabus setis minutis ad apicem instructo; pedibus anticis parvis digito tenui, largè dimidii articuli secundi longitudine; stylis caudalibus brevissimis, parum divaricatis, setâ secundâ corporis longitudine, tertiâ dimidio breviore, primâ perbrevi.

Long. $\frac{1}{16}''$. — *Hab.* in litora ad Valparaiso.

4. Harpacticus linearis. — H. corpore fere lineari, abdomine non angustiore, posticè parum attenuato; antennis anticis brevissimis, 7-articulatis, articulis basalibus duobus crassissimis, primo majore, secundo perbrevi, setis totis brevibus; stylis caudæ styliformibus, articulo abdominis ultimo longioribus, parum divaricatis, setâ secundâ longitudine fere dimidii corporis.

Long. $\frac{1}{20}''$. — *Hab.* in mari, ad Insulas Viti.

5. Harpacticus roseus. — H. corpore fere lineari, abdomine non angustiore, antennis perbrevibus et tenuissimis, basi non crassioribus, setis totis brevibus; stylis caudalibus brevibus, non divaricatis, setâ secundâ corpore longiore, spinulosâ.

Long. $\frac{1}{30}''$. — *Hab.* in mari Sulu.

6. Harpacticus acutifrons. — H. *maris* cephalo-thorace angustè elliptico, anticè acuto, posticè obtuso; abdomine subito angustiore, 6-articulato, posticè valde attenuato, articulo ultimo angustissimo; antennis anticis brevibus, 3 articulis basalibus non oblongis, tertio minimo, quarto crassissimo et cylindrico prope dimidii antennæ longitudine, quinto (forsan duplice), digitiformi, parvulo; antennis juxta basin et ad apicem breviter setigeris; stylis caudalibus minutis non divaricatis, setâ dimidio corporis parum longiore, strictè appressâ, nudâ.

Long. $\frac{1}{24}''$. — *Hab.* in mari prope Tierra del Fuego.

Genus II. CLYTEMNESTRA. (*Dana.*)

Frons subrostrata, appendicibus nullis. *Antennæ anticæ* flexiles; *maris*, non subcheliformes. *Pedes antici* permagni, subcheliformes.

OBS. Non *Arpacticus* Bairdii: *Cyclops chelifer* Arpacticis pertinet. Magnitudo pedium anticorum character genericum non bene validum, nisi pergrandes, quoque pro antennis geniculatis in coitu usitati sunt; ideoque est antennæ *maris* Clytemnestræ non subcheliformes.

CLYTEMNESTRA SCUTELLATA. — C. rostro subacuto; cephalo-thoracis segmento antico lato, posticè utrinque dilatato, tribus segmentis sequentibus subito angustioribus margine posteriore valde arcuatis et lateribus posticè productis et subacutis; abdomine 6-articulato, articulis subæquis, decrescentibus; antennis anticis elongatis 8 (9?)-articulatis, articulo quinto (sexto?) arcuato, sequente oblongo et apice cum appendice instructo (?), reliquis tribus oblongis; setis longis divaricatis, duabus apicalibus fere antennæ longitudine; pedibus anticis pergrandibus, articulo secundo subclavato, digito tenui arcuato fere articuli secundi longitudine.

Long. $\frac{1}{24}''$. — *Hab.* in mari Pacifico, ad lat. 18° S., long. 124° W.; etiam at Insulas Kingsmills; in mari Sinense.

Genus III. SETELLA. (*Dana.*)

Corpus angustissimum fere lineare, anticè attenuatum et subacutum, et fronte appendices duas parvulas falciformes subtus gerens. *Antennæ anticæ* flexiles, appendice brevi instructæ, setis brevibus; *maris* non subcheliformes. *Pedes antici* mediocres aut parvi. *Pedes proximè sequentes* lateraliter porrecti, apice breviter setigeri. *Pedes abdominis* elongati et longè setigeri. *Setæ caudales* duæ longissimæ, (in speciebus scrutatis corpore valde longiores, spinulosæ, et strictè appressæ,) reliquæ brevissimæ. (Tubum cibarium sæpius læte rubrum.)

1. SETELLA TENUICORNIS. — S. antennis anticis fere corporis longitudine, articulis duobus basalibus valde crassioribus, secundo oblongo, reliquis teretibus gracillimis, tertio longissimo, quarto cum appendice instructo; ramis pedis biremis antici subæquis, longiore 3-articulato, articulis fere æquis; pedibus abdominis cum 5–6 setis elongatis subæquis instructis; setis caudalibus corpore fere duplo longioribus.

Long. $\frac{1}{15}''$ setis caudalibus exclusis. — *Hab.* in mari Atlantico meridionali.

2. Setella longicauda. — S. *maris* (?) antennis anticis basi non crassioribus, 7-aut 8-articulatis, articulo quarto paululum arcuato (postice convexo) et cum appendice instructo, tertio fere duplo longiore quam quartus aut secundus ; ramo longiore pedis biremis antici 3-articulato, articulo primo valde brevissimo ; pedum abdominis ramo exteriore brevissimè setigero, interiore duabus setis spinulosis instructo, apicem abdominis fere attingentibus ; setis caudalibus corpore largè duplo longioribus.

Long. $\frac{1}{24}''$. — *Hab.* in mari Atlantico meridionali.

3. Setella gracilis. — S. *feminæ* antennis anticis gracillimis usque ad basin, rectis, inter sese prope 130° divaricatis, articulo primo obsoleto, secundo quartum æquante et dimidio tertio longiore, quarto non arcuato ; digito pedis antici dimidio articulo secundo longiore ; setis caudalibus fere duplo corpore longioribus.

Long. $\frac{1}{24}''$. — *Hab.* in mari Pacifico juxta insulas Kermadec et Tonga.

4. Setella crassicornis. — S. *maris* (?) antennis anticis crassioribus, rectis, inter sese 130° divaricatis, articulo primo obsoleto, secundo tertioque brevibus, quarto appendiculato, hoc etiam sexto ultimoque tertium longitudine duplo superante ; digito pedis antici dimidii articuli secundi longitudine ; setis caudalibus prope sesqui corporis longitudine.

Long. $\frac{1}{24}''$. — *Hab.* in mari Sinense.

5. Setella aciculus. — S. *feminæ* antennis crassiusculis fere rectè divaricatis, ad basin paulum curvatis, articulo primo perbrevi, secundo quartum longitudine æquante et longiore quam tertii dimidium ; pedis antici digito dimidii articuli secundi longitudine ; setis caudalibus sesqui corporis longitudine.

Hab. in mari Indico, prope Fretum Sundæ.

DONATIONS TO THE LIBRARY,

FROM DECEMBER, 1846, TO MAY, 1847.

Prof. S. Kutorga. Naturgeschichte der Infusionsthiere. 8vo. pamph. and Atlas. 4to. St. Petersburg, 1841. From Ch. Cramer, Esq.

Ch. Cramer. Etwas über die Natur-Wunder in Nord-America Zusammengetragen. 8vo. pamph. St. Petersburg, 1840. From the Author.

Fourth Bulletin of the National Institute for the Promotion of Science. 8vo. pamph. Washington, 1846. From the Institute.

Astronomical Observations made during the Year 1845 at the National Observatory, Washington. Vol. I. 4to. Washington, 1846. From the Observatory.

Silliman's American Journal of Science. Vol. III., No. 7, for Jan., 1847. From the Editors.

W. C. Redfield. On three several Hurricanes of the Atlantic, and their Relations to the *Northers* of Mexico and Central America, with Notices of other Storms. 8vo. pp. 118. New Haven, 1846. From the Author.

Maj. James D. Graham. Observations on the Magnetic Dip at several Positions, made in 1840, 1842, 1843, 1844, 1845. (Extr. from American Philos. Trans.) 4to. pamph. Philadelphia, 1846. From the Author.

Dr. Barratt. Report on the Season of 1846, to the Middlesex County Agricultural Society. 8vo. pp. 14. Middletown, Conn., 1846. From the Author.

Dr. Barratt. Geology of Middletown and Vicinity (Sentinel and Witness extra). Middletown, Conn., July 30, 1846. From the Author.

Dr. A. A. Gould. Expedition Shells. 8vo. pp. 25 – 32. Boston, 1846. From the Author.

Prof. E. N. Horsford. Chemical Essays relating to Agriculture. 12mo. Boston, 1846. From the Author.

Prof. E. N. Horsford. Untersuchungen über Glycocoll und einege seiner Zerselzunzsproducte. 12mo. pp. 57. Giessen, 1846.

W. C. Bond, W. C. Bond, Jr., and *G. P. Bond.* Occultations and Eclipses observed at Dorchester and Cambridge, Mass. (Extr. Mem. Amer. Acad.) 4to. pp. 8. 1846. From the Authors.

Asa Gray. Chloris Bóreali Americana. Illustrations of new, rare, or otherwise interesting North American Plants. Decade I. 4to. (Extr. Mem. Amer. Acad., Vol. III.) From the Author.

Wm. S. Sullivant. Contributions to the Bryology and Hepaticology of North America. Part I. 4to. (Extr. Mem. Amer. Acad. Vol. III.) From the Author.

Charles Holtzapffel. Turning and Mechanical Manipulation. 2 vols. 8vo. London, 1846. From the Author.

Charles Holtzapffel. On a Scale of Geometrical Equivalents for Engineering, &c. 8vo. pamph. London, 1838. From the Author.

Charles Holtzapffel. A New System of Scales of equal Parts, ap-

plicable to various Purposes of Engineering, &c. 8vo. London, 1838. From the Author.

Mémoires de l'Academie Imperiale de St. Petersbourg, Tom. VI. and VII. (Sciences Mathematiques, IV., liv. 2de; and Sciences Naturelles, Tom V., livr. 3me and 4me). 1845 – 46.

Mémoires presentés à l'Acad. Imp. Sci. St. Petersbourg, par divers Savans, Tom V., liv. 1 – 6, and Tom. VI., 1re livraison. 1844 – 46. From the Imperial Academy.

Silliman's American Journal of Science and Art. 2d Series, III. 8. for March, 1847. From the Editors.

Philosophical Transactions of the Royal Society of London for 1846. Parts 1, 2, 3. From the Royal Society.

Prof. Challis. Special Report of Proceedings in the Observatory (St. Catherine's Hall Lodge) relative to the New Planet. Dec. 12th, 1846. 4to. pp. 8. From the Author.

J. C. Adams. An Explanation of the Observed Irregularities in the Motion of Uranus, on the Hypothesis of Disturbances by a more distant Planet. (From the Appendix to the Nautical Almanac, for 1851.) 8vo. pp. 32. London. From the Author.

Proceedings of the Royal Astronomical Society. Vol. VII. No. 9. Nov., 1846. 8vo. pp. 16. From the Society.

Daniel Appleton White. Eulogy on John Pickering, LL. D., delivered before the Academy. 8vo. pp. 106. Boston, 1847. From the Author.

The Royal Geographical Society and its Labors. 8vo. pamph. pp. 32. London, 1846.

Fifteenth Annual Report of the Council of the United Service Institution, London. 8vo. pamph. pp. 52. 1846. From the Royal Geographical Society.

Maps of New Haven Harbour and Little Egg Harbour, made under the Direction of the Superintendent of the United States Coast Survey. 2 sheets. From the Superintendent.

Transactions of the Linnean Society of London. Vol. XX., Part 1st. 4to. London, 1846. From the Linnean Society.

Proceedings of the Linnean Society of London. 8vo. pp. 1 – 286. London, 1838 – 46. From the Linnean Society.

A. H. Everett. Critical and Miscellaneous Essays. Second Series. 8vo. Boston, 1846. From the Author.

N. B. Ward, F. L. S. On the Growth of Plants in closely glazed Cases. 8vo. London, 1842. From the Author.

Two hundred and ninety-sixth Meeting.

May 25, 1847. — Annual Meeting.

The President in the chair.

A communication was received, through Mr. Bowen, from Mr. John B. Williams, U. S. Consul at Russell, Bay of Islands, New Zealand, being a meteorological register kept at that place, by Mr. Williams, as follows: —

Meteorological Register

Kept at Russell, New Zealand, from April 24th, 1843, *to Aug.* 14*th*, 1844.

Date.	Fahrenheit Thermometer in the Shade. 8 A. M.	12 M.	8 P. M.	Winds and Weather.
1843, April 24,	70°	70°	96°	N. W.; rain squalls.
25,	63	64	63	N. W. and pleasant.
26,	64	60	54	N. and strong gales.
27,	54	58	54	N.; rain, strong gales, ends pleasant.
28,	50	54	50	N. W.; clear and pleasant.
29,	50	48	57	S. W.; clear, ends squally, with rain.
30,	55	64	56	Light airs, calms, ends strong breeze, S. E.
May 1,	58	70	58	N. E. and pleasant.
2,	58	63	58	Light airs from S. W. and pleasant.
3,	58	63	58	" " N. E. " "
4,	58	60	59	S. E.; strong breezes and cloudy.
5,	59	60	60	S. " " "
6,	58	60	60	" " " "
7,	60	65	63	N. E. " " and rain.
8,	63	63	60	N., with rain; ends S. W. and squally.
9,	57	57	56	S. W.; light breeze.
10,	52	56	53	S. W.; strong breezes from S. W.
11,	52	56	53	" " " " "
12,	52	56	53	" " " " "
13,	45	58	57	W.; light breezes and clear.
14,	52	56	59	" " " "
15,	62	62	61	Gale from E. S. E., attended with rain.
16,	62	62	61	E.; strong winds, and rain.
17,	62	62	62	" " " "
18,	62	64	61	E. N. E.; rain; ends clear.
19,	60	61	59	S. E.; light breezes and rain.
20,	60	60	60	E. " " and foggy.
21,	65	64	64	E. N. E. and rain squalls.
22,	62	64	62	N.; squally.
23,	62	62	59	N. W., and heavy squalls.
24,	52	59	59	S. W.; light breeze, and pleasant.
25,	59	59	59	S. E. and squally; ends N. W. to N.E. and pleasant.
26,	57	57	59	Strong breezes and pleasant.
27,	53	57	54	W. S. W.; strong breezes.
28	56	56	56	W., and pleasant.
29,	52	54	52	S. S. W. and pleasant.
30,	52	50	49	S. S. E. and pleasant; latter part rain.
31,	49	59	51	Gale from S. S. E., with rain.

Date.	Fahrenheit Thermometer in the Shade. 8 A. M.	12 M.	8 P. M.	Winds and Weather.
1843,	°	°	°	
June 1,	49	59	51	S. W.; strong breezes and pleasant.
2,	52	59	50	S.; mild and pleasant.
3,	44	58	54	S. W.; light winds and pleasant.
4,	54	59	58	S. E; light breezes and cloudy.
5,	59	62	62	N. N. E.; cloudy.
6,	60	62	60	N. N. E. and rain.
7,	60	62	60	" " "
8,	55	59	52	S. W. and pleasant.
9,	55	55	55	N. W. and rain.
10,	55	55	55	S. W.; pleasant, ends squally.
11,	46	56	50	" " " "
12,	49	52	50	W.; strong breeze, and clear.
13,	46	50	46	" " " "
14	46	50	46	" " " ends squally.
15,	50	55	50	W. and squally.
16,	50	55	48	" "
17,	50	55	55	N. E. and clear.
18,	60	60	50	E.; a gale and clear.
19,	50	50	47	S. W.; " "
20,	47	53	50	S. W. and clear.
21,	45	50	47	S. W. and pleasant; ends calm.
22,	42	59	60	S E. to N. E.; variable, lightning, calms, and gales.
23,	53	60	60	N. W.; heavy squalls of rain.
24,	51	60	61	W. and clear; ends N. E. and rain.
25,	60	62	60	E. and rain; S. and clear.
26,	55	62	60	S. W. and clear.
27,	50	61	58	" "
28,	55	61	57	" "
29,	58	65	60	W. and heavy squalls.
30,	58	66	53	E. and light breeze.
July 1,	50	69	53	S. E. and squally.
2,	54	52	54	N. W. and rain squalls.
3,	53	51	53	N. E. and rain.
4,	51	52	49	Calm; ends S. W.
5,	50	50	52	S. W. and pleasant.
6,	46	52	47	S. and strong breezes.
7,	47	55	56	S to N. W. and rain.
8,	45	60	53	W. and squally, with rain.
9,	50	52	50	Calm and pleasant.
10,	50	59	52	S. W. and squally.
11,	50	50	54	S. W. and fine weather.
12,	59	52	54	S. W. and clear.
13,	59	52	54	" "
14,	50	54	57	S. W. and squally.
15.	57	53	49	N. E. and squally.
16.	50	57	55	S. W. and clear.
17,	50	63	49	S. W.
18,	55	58	58	Calm; ends W., and rain squalls.
19,	58	60	57	Calm; ends W. N. W. and foggy; squally.
20,	50	47	46	W. N. W. and heavy squalls of rain.
21,	44	50	44	W. N. W. and clear.
22,	49	54	59	E. N. E. and rain.
23,	49	57	49	S. W.; rain and squally.
24,	49	49	53	S. S. W. and very bleak.
25,	42	54	51	S. S. W. and rain.
26,	47	61	52	S. S. W. and cloudy.
27,	56	58	51	Calm; ends N. W.; thunder and lightning.
28,	52	57	52	W. and squally.

Date.	Fahrenheit Thermometer in the Shade. 8 A. M.	12 M.	8 P. M.	Winds and Weather.
1843,	°	°	°	
July 29,	48	48	52	S. W.; cloudy and squally.
30,	52	46	52	S. E. and pleasant.
31,	51	58	52	N. by W. and pleasant.
Aug. 1,	56	55	53	N. by E.; rain, and strong gales.
2,	53	58	49	N. W. to S. W.
3,	57	61	53	E. N. E.
4,	54	63	55	N. by E. and rain.
5,	52	56	52	S.
6,	46	52	55	W. by N. and squally.
7,	53	56	55	" " "
8,	52	51	53	W. by S. and squally.
9,	50	60	54	W. S. W. and strong breezes.
10,	48	61	52	Calm and rain.
11,	47	60	54	S. W. and foggy; strong breezes.
12,	51	62	54	N. and foggy.
13,	51	71	54	N. E. and rain.
14,	58	60	57	N. and rain.
Sept. 16,	57	61	57	N. W.; strong breezes and fine weather.
17,	57	45	53	W.; strong breezes and squally.
18,	51	60	51	S. W.; clear and fine weather.
19,	47	51	62	S. E.; light airs and clear.
20,	51	63	62	S. S. E.; strong breezes and clear.
21,	52	60	59	S.; light airs and cloudy.
22,	54	67	60	N.; light airs and cloudy.
23,	60	64	59	N. W.; strong breezes and squalls of rain.
24,	61	66	58	N. N. W.; strong breezes and squally.
25,	59	65	55	W. by N. and light airs.
26,	55	62	47	N. W.; strong breezes and rain.
27,	56	56	58	S. S. W.; squally, with rain.
28,	55	59	57	S. S. W.; fine breezes, with rain.
29,	59	63	59	S. S. W. and clear.
30,	57	66	54	" "
Oct. 1,	54	54	49	S. W.; squally, attended with rain.
2,	54	57	50	S. W.; heavy squalls, attended with rain.
3,	53	55	50	Heavy squalls of rain from W. S W.
4,	54	57	59	N. W. to S. W. and passing clouds.
5,	53	55	53	Heavy rain from S. E.
6,	53	54	58	E.; a gale, with heavy rain.
7,	59	62	56	E. and clear; ends passing clouds.
8,	57	67	57	E.; strong breezes and squally.
9,	58	59	59	E. N. E.; strong breezes and rain.
10,	59	61	59	Strong gales from E.
11,	59	61	54	E. and squally.
12,	58	67	59	E. N. E.; strong breezes with rain.
13,	60	62	60	E. S. E.; " " " "
14,	61	67	53	N. E. to N. W. and cloudy.
15,	58	64	59	N. W.; squalls of rain.
16,	55	59	54	W.; " "
17,	54	50	50	Winds variable; heavy squalls of hail and rain.
18,	55	53	55	W. and rain squalls.
19,	52	55	53	W. and squally, with rain.
20,	56	56	58	" " " "
21,	50	50	53	W.; fine breezes and clear.
22,	50	50	56	S. E.; squally; hail, thunder and lightning.
23,	56	56	60	W. S. W.; clear; ends cloudy.
24,	62	62	58	N. N. W.; strong gales and cloudy.
25,	56	56	58	S. W.; strong breezes and clear.

Date.	Fahrenheit Thermometer in the Shade. 8 A. M.	12 M.	8 P. M.	Winds and Weather.
1843, Oct. 26,	58°	58°	57°	S. E.; strong breezes and clear.
27,	53	53	54	" " " "
28,	56	56	57	S. E. and clear sky.
29,	57	57	59	N. W. and strong gales.
30,	59	59	57	W. and cloudy.
31,	58	58	57	N. to W.; heavy squalls of rain.
Nov. 1,	55	55	57	W.; strong gales and squally.
2,	55	55	50	S. W.; heavy squalls.
3,	57	57	57	S. S. W. to W.; a gale.
4,	59	59	60	" " "
5,	64	64	62	S. W. to N. W.; strong breezes.
6,	62	62	60	S. W. to S.; most unusual weather for the season.
7,	64	64	67	N. W. and cloudy; unusual weather for the season.
8,	60	60	60	S. W. to N. W.; hard gales.
9,	60	60	59	N. N. W. and clear.
10,	62	62	56	W. by N. to S. W.; rain.
11,	62	62	56	S. W.; clear and fine.
12,	60	60	60	N. W. and heavy squalls.
13,	60	60	56	S. W. and heavy squalls.
14,	56	56	56	W. N. W.; strong breezes.
15,	58	58	62	W. N. W. and squally.
16,	59	59	62	W. N. W. and cloudy.
17,	61	61	57	W. and passing clouds.
18,	56	56	59	S. W.; most perfect day.
19,	57	57	58	S. W.; fine and clear.
20,	54	54	58	W.; clear.
21,	55	66	59	E. and squally.
22,	56	60	58	" "
23,	54	61	59	W. and clear.
24,	58	66	58	S. W. and clear.
25,	66	82	78	N. E.; fine breezes and pleasant.
26,	60	66	60	" " " "
27,	66	66	60	" " " "
28,	62	65	60	N. E. and rain.
29,	60	66	60	N. W. to S. W. and light airs.
30,	60	65	58	S. W. to N. W. and strong breezes.
Dec. 1,	58	62	54	N. and cloudy; latter part W. S. W. and clear.
2,	57	64	57	S. S. W.; strong breezes and pleasant.
3,	57	64	57	" " " "
4,	60	75	60	N. E. and pleasant.
5,	59	75	60	S.; fine breezes and pleasant.
6,	59	73	60	N. E. and pleasant.
7,	64	72	65	N. W. and cloudy.
8,	65	73	65	N. E. by E. and passing scud.
9,	70	75	67	E.; light breezes and cloudy.
10,	67	72	64	" " " " "
11,	64	65	62	E. S. E.; light breezes; ends in strong gales.
12,	64	68	65	S. E.; light breezes.
13,	65	70	62	E. to E. S. E.; passing squalls of rain.
14,	65	70	65	" " " " "
15,	65	82	68	N. E. to E. S E.; light breezes and rain.
16,	68	82	66	N. E. to S. E.; light airs and cloudy.
17,	63	84	68	S.; light breeze; N. E. and pleasant.
18,	62	78	60	S. W.; fine breeze and pleasant.
19,	55	85	60	Light easterly winds and very pleasant.
20,	60	80	60	S. W.; fine breezes and pleasant.
21,	60	69	60	S. W.; strong gales and passing clouds.

Date.	Fahrenheit Thermometer in the Shade. 8 A. M.	12 M.	3 P. M.	Winds and Weather.
1843,	°	°	°	
Dec. 22,	62	62	49	S. W. and strong gales.
23,	59	73	59	S. W. and pleasant.
24,	60	73	63	S. W.; strong breezes; in the bay, N. and pleasant.
25,	65	70	60	N. W.; light breezes and pleasant.
26,	60	70	65	W.; strong breezes and cloudy.
27,	62	73	62	N.; light breezes.
28,	66	80	68	S. W.; light breezes and pleasant.
29,	66	89	68	" " " "
30,	67	87	68	S. E. and light airs.
31,	70	86	73	S. E. to N. E. and pleasant.
1844,				
Jan. 1,	72	85	78	N. E. and pleasant.
2,	72	80	70	S. W.; strong breezes and pleasant.
3,	71	75	70	" " " "
4,	67	71	65	W.; light airs and pleasant.
5,	66	68	62	N. E.; light breeze and cloudy.
6,	70	74	65	" " " "
7,	63	79	70	N. E.; fine breeze.
8,	63	79	66	N. E.; fine breeze and pleasant.
9,	63	84	66	" " " "
10,	63	77	66	" " " "
11,	64	78	66	N. to N. N. E.
12,	65	77	79	S. E. and pleasant.
13,	66	82	70	N. E.; fine breezes and pleasant.
14,	72	75	65	S. E.; strong breezes and cloudy.
15,	67	73	68	" " " "
16,	68	75	68	S. E.; light breezes and cloudy.
17,	70	79	68	S.; light breezes and pleasant.
18,	66	89	80	S.; light breezes and cloudy.
19,	70	78	70	E.; light breezes and rain.
20,	71	87	74	S. E. and pleasant.
21,	75	85	72	N. E.; light breeze and pleasant.
22,	71	68	65	N. N. W.; rain and squally.
23,	70	82	70	S.; fine breeze and pleasant.
24,	71	79	70	N.; light airs and pleasant.
25,	71	84	68	N. E.; light airs and rain.
26,	70	80	70	S. E.; light airs and pleasant.
27,	70	85	70	N. E. to E.; light airs and pleasant.
28,	68	86	70	E.; fine breezes and pleasant.
29,	68	73	70	N. W.; strong breezes and cloudy.
30,	70	84	72	N. E. to S. E.; light breezes and pleasant.
31,	70	76	68	S E.; strong breezes and pleasant.
Feb. 1,	61	69	63	N. E.
2,	63	74	68	N E.; fine breezes and cloudy.
3,	62	80	68	N. E.; strong breezes and rain.
4,	62	77	68	S. S. E. to E.; with rain.
5,	69	76	69	N. E.; strong breezes.
6,	64	69	64	N. E ; strong breezes, attended with rain.
7,	64	72	69	S. S. E. to E., attended with rain.
8,	69	76	69	E.; light breezes and cloudy.
9,	69	76	69	N. E.; foggy and rain.
10,	69	76	68	N E to S. E. and rain.

"March, April, and May are the Autumn months; June, July, and August, the Winter; September, October, and November, the Spring; December, January, and February, the Summer. The Spring months were unusually cold and tempestuous."

The Vice-President read a letter from M. Leverrier, in acknowledgment of Mr. Bond's observations upon the new planet; and also one from Professor Liebig, giving an account of his recent researches upon the composition of flesh.

A communication from Professor Daubeny was read, conveying an invitation to the meeting of the British Association for the Promotion of Science, to be held at Oxford, on the 23d of June.

The Treasurer's report, accompanied by the Auditor's certificate, was received and read.

Professor Edward Robinson, of New York, and Professor Charles C. Jewett, of Brown University, were elected Corresponding Members of the Academy.

Professor Eben N. Horsford, of Cambridge, Horace Gray, Esq., of Boston, and John C. Lee, Esq., of Salem, were elected Fellows.

The American Antiquarian Society was invited to use the Academy's room for such of its meetings as are held in Boston.

At the annual election, the following gentlemen were chosen officers for the ensuing year, namely: —

JACOB BIGELOW, M. D., . . *President.*
Hon. EDWARD EVERETT, . *Vice-President.*
ASA GRAY, ... *Corresponding Secretary.*
OLIVER W. HOLMES, M. D., *Recording Secretary.*
J. INGERSOLL BOWDITCH, . . *Treasurer.*
A. A. GOULD, M. D., ... *Librarian and Cabinet-Keeper.*

The standing committees were appointed by the chair, as follows: —

Rumford Committee.

DANIEL TREADWELL, BENJAMIN PEIRCE,
JOHN WARE, M. D., JAMES HAYWARD,
FRANCIS C. LOWELL.

Committee of Publications.

ASA GRAY, FRANCIS BOWEN, WM. C. BOND.

Committee on the Library.

A. A. GOULD, D. H. STORER, BENJAMIN PEIRCE.

Two hundred and ninety-seventh Meeting.

August 11, 1847. — Quarterly Meeting.

The President in the chair.

The Corresponding Secretary laid on the table an engraved portrait of the late Professor De Candolle, a Foreign Honorary Member of the Academy, presented by his son, Prof. Alphonse De Candolle, of Geneva. On motion of the Vice-President, it was gratefully accepted, and ordered to be placed in a frame.

The following gentlemen were elected Foreign Honorary Members of the Academy, viz.: —

The Rev. Dr. Whewell, Master of Trinity College, Cambridge.

M. U. J. Leverrier, of Paris.

John C. Adams, Esq., Fellow and Tutor of St. John's College, Cambridge University.

The following gentlemen were chosen Fellows of the Academy, viz.: —

Hon. Samuel A. Eliot, of Boston.

Benjamin A. Gould, jr., of Boston.

George P. Bond, Assistant at the Observatory, Cambridge.

Mr. Everett stated, that, as President of the University, he felt it his duty, on behalf of the Corporation, to embrace the earliest opportunity of formally acquainting the Academy that the great telescope ordered for the Observatory at Cambridge had arrived in good order in all parts, and had been successfully mounted. The object-glass was received in November last, and the other portions a short time since. The delicate and somewhat difficult task of mounting and adjusting this very large instrument had been performed with great expedition and skill by Mr. Bond and his son, the Director and Assistant Observer. Mr. Everett felt bound to make this statement to the Academy, and to accompany it with the renewed acknowledgments of the Corporation for the very liberal subscription of the Academy to the fund for purchasing the telescope. This subscription, amounting to three thou-

sand dollars, was not only in itself of the greatest importance, but had been still more useful from having been tendered at the earliest stage of the enterprise, and when its success was uncertain. He further stated, that, although the instrument had been but for a very short time in operation, its performance was such as to warrant the belief, that it fully came up to the conditions of the order under which its manufacture was undertaken by Messrs. Merz and Mahler, — which were, that it should be as good as any instrument of its class in the world.

Mr. Everett then read the following letter from Mr. Bond, the Director, furnishing some information in detail as to the performance of the instrument in reference to test objects.

" *Observatory at Cambridge*, 26 *July*, 1847.

" Dear Sir : —

" I take great pleasure in complying with the request you made, during your last visit to the Observatory, that I should prepare for you a brief account of the large refracting telescope which has recently been placed within its walls.

" The construction of this instrument was intrusted to the eminent opticians and mechanicians, Messrs. Merz and Mahler, of Munich, in Bavaria, the successors of the celebrated Frauenhofer. By the terms of the contract, they bound themselves to make for us a telescope equal in dimensions to the one at Pulkova, and of the best quality they were able to produce. We received the object-glass of this telescope in November, 1846. The tube and machinery arrived on the 11th of last month. We had prepared for the support of this instrument a stone pier, composed of massive blocks of granite, resting on a bed of hydraulic cement, made with coarse gravel, which forms a mass almost as solid as the stone itself. The substratum is fine gravel mixed with sand. The diameter of the pier is twenty feet at the base, and ten feet at the top. In form it is the frustum of a cone, and is surmounted by a single block of granite, two feet in thickness and ten feet in diameter, weighing fourteen tons. On this rests the stone pedestal, eleven feet high, weighing about nine tons, to which are attached the bed-plate of the hour-axis and framework of the telescope. Five hundred tons of granite were employed in constructing this pier.

" The hour-circle of the instrument is eighteen inches in diameter, and reads by two verniers to single seconds of time in right ascension.

The declination-circle is two feet in diameter, and reads by four verniers to four seconds in arc. The object-glass has fifteen inches clear aperture, and twenty-two feet eight inches focus. It is furnished with a filar-position micrometer, and four annular micrometers. There are eighteen eye-pieces, the highest power being estimated by the maker at two thousand. After adjusting and securing the various parts, the whole was found to move freely and steadily under clock-work, it being well balanced in all its parts, and the friction greatly reduced, by a judicious arrangement of counterpoises and friction-wheels. The instrument is protected from the weather by a dome of thirty feet interior diameter. It moves freely on eight cannon-balls, and is secured from displacement by storms, by eight iron braces, which are secured to the walls of the building, and present friction-wheels to the opposite sides of the interior of the dome. The opening is five feet wide; the shutters are opened and closed by means of endless chains, working in teethed pulleys turned by a crank. I omit the details of mounting the telescope, as they are of little general interest, and will be given in the report to the Visiting Committee on the Observatory, when I hope to be enabled to add to them an account of the new transit-circle, which Mr. Simms has nearly completed.

"In regard to the ultimate capabilities of our telescope, we cannot be expected, from so short a trial, to have formed any very decisive opinion. It has, however, even under the disadvantage of a bad state of the atmosphere, exceeded our expectations. We have had the best opportunities of making observations during the early morning hours.

"Of the close double stars, our attention was first directed to η Coronæ. The components appeared round, small, and well separated. The difficult double star γ Coronæ, which Captain Smyth ranks in his 'Cycle' as the 'Præses of Struve's vicinissimæ,' was well separated, a dark space appearing between the principal star and its satellite. On the morning of the 20th July, the companion of γ Andromedæ was also well separated. The line micrometer gave a distance of three tenths of a second. I was surprised to find, on following this object into day-light, that our measures of distance could be taken after sunrise. I measured, alternately with my son, both in distance and position, while the sun was shining on the telescope, and we both thought that we saw them full as well, or rather better, after sunrise than before. This might be owing to a quieter state of the atmosphere consequent on a rise of the thermometer. On the evening of the 15th of July, the nebula No. 27 Messier, commonly known as

the dumb-bell nebula, exhibited a multitude of points of light, with a few larger stars, which were probably accidental, or not belonging to it, scattered over its surface. Three observers were confident of the resolution of this nebula. It occupied considerably more space than the field of the telescope would take in, and the form by which it has hitherto been distinguished was entirely lost. There appear, however, to be two centres of condensation.

"On the same evening, α Lyræ was examined. It showed a small round disk; but the troubled state of the atmosphere rendered it unsteady. Thirty-five stars were counted in the same field with it. The ring nebula of Lyræ was beautifully shown. My friend, Hon. Wm. Mitchell, who was observing with us, was confident that he saw many stars within the compass of the ring.

"The companion of Antares, discovered by Professor Mitchell of Cincinnati, was quite conspicuous, notwithstanding the tremulous state of the atmosphere at the low altitude of the star. The great nebula in Andromeda has a bright central point closely resembling a star. I do not recollect having seen any notice of this.

"On examining the moon near the quadrature, the light is so exceedingly vivid, when the whole aperture of the object-glass is used with a power of 180, that it becomes painful to the eye. With higher powers, the mountains are brought out in bold relief, and the depths are opened. On the evening of the 20th, having a friend with me who takes a strong interest in these matters, we were examining the moon along the boundary of light and darkness, and saw what had every appearance of being the effect of atmospheric refraction. The deep black shadows of the rugged mountain-tops, stretching far across the plains until they were lost sight of in the unilluminated portion, enabled us by contrast to distinguish what seemed to be the first gray tint of dawn, and to trace the gradually increasing light to the full splendor of mid-day.

"But I must recollect that you require of me only a brief account of our telescope. The objects revealed to us by this excellent instrument are so numerous and interesting, that it is difficult to know where to stop.

"With the highest regard and respect,

"I remain, dear Sir, yours sincerely,

"W. CRANCH BOND.

"To President Everett."

In conclusion, Mr. Everett expressed the hope, that the members of the Academy might eventually witness such accessions to the astronomical science of the country, from the observations made by this admirable instrument, as would be considered by them a satisfactory equivalent for so large an appropriation of the Academy's funds.

Two hundred and ninety-eighth Meeting.

October 5, 1847. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary presented a communication from Professor Henry, Secretary of the Smithsonian Institution, in reference to the organization of that institution; which, on motion of the Vice-President, was referred to a committee, consisting of Mr. Everett, Prof. Gray, Prof. Agassiz, Prof. Peirce, Prof. Longfellow, and Prof. Sparks.

Mr. Bond communicated the following

OBSERVATIONS ON THE PLANET NEPTUNE, NEAR ITS QUADRATURE.

Made at Cambridge Observatory, Long. $4^{h.}\ 44^{m.}\ 32^{s.}$.

Cambridge M.S.T. of Observation.	Planet follows No. 7740 B. A. C.	Planet south of No. 7740 in Dec.	Mean Position of Star, Jan. 1, 1847.	No. of Comp.
1847. d. h. m	m. s.	′ ″	h m. s.	
May 14 15 44	6 08.67	5 04.9	A. R. 22 04 07.53	4
19 15 39	6 19.30	4 17.3	Dec. —11° 49′ 04″.4	1
20 15 42	6 20.55	4 12.2		6
28 15 44	6 29.17	3 37.1		5

OBSERVATIONS ON THE PLANET NEPTUNE, MADE WHEN NEAR ITS OPPOSITION.

Cambridge M.S.T. of Observation.	App. A. R. of Neptune.	Obs. — Eph.	App. Declination of Neptune.	Obs. — Eph.	Mean position of 38 Aquarii, Jan. 1, 1847.	No. of Comp.
1847. d. h. m.	h. m. s.	s.	° ′ ″	″	h. m. s.	
Aug. 18 11 13	22 05 41.75	—0.03	—12 21 42.9	+0.2	A. R. 22 02 26.57	4
" 20 10 11	22 05 29.36	—0.13	—12 22 51 2	—0.5	Dec. —12° 18′ 52″.0	8
" 21 10 32	22 05 22.89	—0.25	—12 23 26.5	— 0.7	38 Aquarii is No.	10
" 23 10 26	22 05 10.40	—0.22	—12 24 37.6	+0.6	7722 B. A. C.	6

The columns headed "Observed — Ephemeris" contain a comparison with Mr. Adams's Ephemeris in the June number of the Notices of the London Astronomical Society.

Mr. Bond also presented the subjoined

Observations on Mauvais's Comet of July 4th, 1847.

Cambridge Mean Solar Time.					Comet's A. R.	Comet's Dec. N.	Star of Comparison. A. R.	Star of Comparison. Dec. N.	No. of Comp.	
1847.	d.	h.	m.	s.	h. m. s.	° ′ ″	h. m. s.	° ′ ″		
July	14	11	45		16 20	85 14				
	20	10	26		13 59 26.7	80 53 00	13 50 33.73	80 40 41.2	4	Hist.Cel.p. 394.
	23	10	46	54	13 34 00.8	78 14 03	13 42 04.80	78 49 50.0	4	B. A. C. 4614.
	24	10	06	30	13 28 35.1	77 22 27	13 32 41.03	77 19 41.6	5	Arg. Zone, 194.
	27	10	49	10	13 15 55.5	74 41 23	13 00 05.37	73 50 40 5	.6	Gr. 1960.
	31	10	13	12	13 05 59.4	71 14 11	12 53 43.30	71 25 22.0	3	Arg. Zone, 200.
Aug.	3	10	32	48	13 01 15.4	68 43 14	12 26 55.11	70 37 55.7	2	5 Draconis.
	10	9	11	00	12 55 48.2	63 12 43	13 00 19 88	62 51 47.9	3	B. A. C. 4392.
Sept.	6	9	15	01	12 57 09.7	46 18 24	12 58 58.44	43 54 44.6	7	B. A. C. 4389.
Oct.	11	7	07	30	13 09 46.2	32 35 45	13 11 02.75	32 26 23.1	3	Bess. Zone, 408.

"*July* 14*th*. The comet was first seen at $11^{h.}$ $45^{m.}$ P. M.; but after watching its position for some time, we could detect no indication of motion relatively to the neighbouring stars, so that it was not recognized as a comet until six days after. Its position, as given above, was taken from the circles of the five-foot equatorial.

"*July* 20*th*. The comet was observed to-night with the five-foot equatorial, using the annular micrometer for the comparisons. It disappears sharply behind the ring, with almost as much certainty as a star; indicating a sudden condensation of light at the centre. This was afterwards confirmed, on examination with the great refractor recently mounted in the dome of the Observatory. With the full aperture of fifteen inches, a very minute stellar point is visible in the centre of the comet, with a sparkling light, easily distinguishable from the diffused nebulosity which surrounds it.

"*July* 23*d*. The observations were made this evening with the great equatorial, by differentiating with the hour and declination circles. In high declinations this method allows the comparisons to be oftener repeated than is otherwise practicable. In declination the comparisons have a better mutual agreement than we have been able to obtain when using the annular micrometer.

"*July* 24*th*. The comet does not sensibly increase in brightness. The stellar point is visible through strong moonlight.

"*Sept.* 3*d*. The comet still shows a star-like nucleus. A faint tail is visible, of six or eight minutes in length.

"*October* 11*th*. The differences of right ascension this evening are somewhat uncertain, the altitude being too low for accurate observations.

"It seems necessary to remark, that the above places of the comet

given by the great refractor of Cambridge University, having been obtained in every case from instrumental readings, and not from micrometric comparisons, are not determined with the full accuracy which the instrument is capable of affording. The mode of observation has been, to bring the object, by *estimation*, to the centre of the field of view, marking the time, and reading the circles for each in succession, and thence deriving their relative positions; a method which, however unpromising it may at first sight appear, affords, with practice, better differences of declination than are easily obtained, with smaller instruments, by the aid of the micrometer, and in high declinations is often decidedly preferable for right-ascension differences. The right ascensions and declinations of the comet were obtained by applying the observed differences to the place of the star of comparison referred to the mean equinox of Jan. 1st, 1847.

Mr. Bond presented for publication a new series of moon culminations, observed at the Cambridge Observatory during the past and present year.

MOON CULMINATIONS,

Observed at Cambridge, Corrected for Instrumental Errors, Clock Error, and Rate.

Date.		Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
			h. m. s.	s.	s.	
1846, July	3	☽'s 1st Limb	14 14 56.81			B²*
	"	ε Bootis	14 38 18.00	18.07	+0.07	"
	"	α^2 Libræ	14 42 25.16	25.28	+0.12	"
	"	β Libræ	15 08 46.86	46.74	—0.12	"
	4	α^2 Libræ	14 42 25.27	25.27	0.00	B¹
	"	☽'s 1st Limb	15 10 36.28			"
	6	ε Bootis	14 37 18.24	18.04	—0.20	"
	"	α^2 Libræ	14 42 25.55	25.26	—0.29	"
	"	β^1 Scorpii	15 56 32.43	33.01	+0.58	"
	"	δ Ophiuchi	16 06 19.99	20.10	+0.11	"
	"	α Scorpii	16 20 02.55	02.37	—0.18	"
	"	☽'s 1st Limb	17 12 29.81			"
	"	D Ophiuchi	17 34 16.65	16.36	—0.29	"
	7	α Bootis	14 08 40.74	40.63	—0.11	"
	"	ε Bootis	14 38 18.14	18.03	—0.11	"
	"	α^2 Libræ	14 42 25.25	25.25	0.00	"
	"	α Scorpii	16 20 02.11	02.37	+0.26	"
	"	φ Ophiuchi	17 11 50.36	50.30	—0.06	"

* B¹ is the initial of *William C. Bond*; B², of *G. P. Bond*.

Date.	Name of Object.	Sidereal Time of Meridian Passage			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1846, July 7	D Ophiuchi	17	34	16.18	16.36	+0.18	B[1]
"	☽'s 1st Limb	18	17	09.95			"
"	σ Sagittarii	18	45	47.38	47.01	−0.37	"
"	ο Sagittarii	18	55	31.18	31.11	−0.07	"
12	☽'s 2d Limb	23	26	35.60			"
"	ι Piscium	23	32	04.64	04.61	−0.03	"
"	ω Piscium	23	51	26.95	26.99	+0.04	"
"	γ Pegasi	0	05	21.46	21.51	+0.05	"
15	α Arietis	1	58	32.68	32.68	0.00	B[2]
"	☽'s 2d Limb	2	05	14.49			"
Aug. 3	Antares	16	20	01.90	02.15	+0.25	"
"	η Ophiuchi	17	01	36.65	36.60	−0.05	"
"	α Herculis	17	07	40.86	40.60	−0.26	"
"	ϑ Ophiuchi	17	12	37.41	37.22	−0.19	"
"	ρ Draconis	17	26	59.75	59.91	+0.16	"
"	D Ophiuchi	17	34	16.14	16.12	−0.02	"
"	☽'s 1st Limb	17	44	33.40			"
"	μ^1 Sagittarii	18	04	37.23	37.24	+0.01	"
"	λ Sagittarii	18	18	31.96	32.18	+0.22	"
4	γ Draconis	17	53	04.47	04.62	+0.15	B[1]
"	μ^1 Sagittarii	18	04	37.24	37.23	−0.01	"
"	λ Sagittarii	18	18	32.09	32.17	+0.08	"
"	α Lyræ	18	31	46.68	46.47	−0.21	"
"	☽'s 1st Limb	18	48	41.10			"
"	π Sagittarii	19	00	40.46	40.33	−0.13	"
5	μ^1 Sagittarii	18	04	37.21	37.23	+0.02	B[2]
"	α Lyræ	18	31	46.47	46.47	0.00	"
"	π Sagittarii	19	00	39.94	40.33	+0.39	"
"	β Aquilæ	19	47	48.70	48 53	−0.17	"
"	γ Aquilæ	19	38	59.69	59.68	−0.01	"
"	α Aquilæ	19	43	19.82	19.78	−0.04	"
"	☽'s 1st Limb	19	53	12.07			"
"	ε Aquarii	20	39	23.91	24.08	+0.17	"
"	α^2 Capricorni	21	09	34.08	34.24	+0.16	"
12	☽'s 2d Limb	2	47	41.49			B[1]
"	α Tauri	4	27	07.98	07.84	−0.14	"
"	Capella	5	05	22.03	22.17	+0.14	"
31	D Ophiuchi	17	34	15.83	15.90	+0.07	B[2]
"	γ Draconis	17	53	03.91	03.89	−0.02	"
"	μ^1 Sagittarii	18	04	36.94	36.92	−0.02	"
"	☽'s 1st Limb	18	19	01.60			"
"	σ Sagittarii	18	45	46 88	46.84	−0.04	"
Sept. 4	β Aquarii	21	23	30.80	30.77	−0.03	"
"	β Cephii	21	26	44.40	44.33	−0.07	"
"	ε Pegasi	21	36	41.30	41.18	−0.12	"
"	α Aquarii	21	57	55.99	56.22	+0.23	"
"	ϑ Aquarii	22	08	46.06	46.03	−0.03	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1846, Sept. 4	☽'s 1st Limb	22	27	07.83			B²
"	ζ Pegasi	22	33	51.06	50 94	−0.12	"
"	q Piscium	23	53	59.87	59.90	+0.03	"
6	☽'s 2d Limb	0	28	02.39			"
"	α Cassiopeæ	0	31	53.83	53.94	+0.11	"
"	β Ceti	0	35	55.07	54.97	−0.10	"
"	ε Piscium	0	55	01.34	01.31	−0.03	"
"	l Piscium	1	00	30.50	30.41	−0.09	"
7	l Piscium	1	00	30.11	30.43	+0.32	"
"	η Piscium	1	23	18.87	18.99	+0.12	"
"	☽'s 2d Limb	1	21	20.86			"
"	π Piscium	1	29	00.21			"
"	o Piscium	1	37	19.74	19.66	−0.08	"
"	α Arietis	1	58	34.24	34.22	−0.02	"
"	ξ¹ Ceti	2	04	54.13	54.19	+0.06	"
9	α Ceti	2	54	17.54	17.50	−0.04	"
"	δ Arietis	3	02	54.09	53.48	−0.61	"
"	α Persei	3	13	26.16	26.39	+0.23	"
"	☽'s 2d Limb	3	21	11.24			"
"	η Tauri	3	38	24.32	24.12	−0.20	"
11	α Tauri	4	28	08.73	08.73	0.00	"
"	Capella	5	06	23.37	23.37	0.00	"
"	☽'s 2d Limb	5	14	20.25			"
28	μ¹ Sagittarii	18	04	36.56	36.40	−0.16	B¹
"	2125 A. S. Cat.	18	20	28.53	28.31	−0.22	"
"	α Lyræ	18	31	45.05	45.33	+0.28	"
"	☽'s 1st Limb	18	57	03.09			"
"	β Lyræ	18	44	25.98	25.90	−0.08	"
"	d Sagittarii	19	08	40.70	40.81	+0.11	"
"	φ¹ Sagittarii	19	12	47.49	47.81	+0.32	"
29	α Lyræ	18	31	45.28	45.30	+0.02	"
"	β Lyræ	18	44	25.91	25.90	−0.01	"
"	d Sagittarii	19	08	40.83	40.79	−0.04	"
"	φ¹ Sagittarii	19	12	47.85	47.79	−0.06	"
"	☽'s 1st Limb	19	57	29.70			"
30	☽'s 2d Limb	20	57	39.37			"
"	ζ Pegasi	21	06	26.68	26.50	−0.18	"
"	ε Pegasi	21	36	40.82	41.00	+0.18	"
Oct. 3	β Piscium	22	56	05.97	06.36	+0.39	B²
"	γ Piscium	23	09	14.53	14.96	+0.43	"
"	γ Cephii	23	33	14.02	14.08	+0.06	"
"	γ Ursæ Maj.	23	45	42.07	42.32	+0.25	"
"	ω Piscium	23	51	28.09	28.28	+0.19	"
"	☽'s 1st Limb	23	54	59.86			"
"	α Andromedæ	0	00	30.82	30.72	−0.10	"
"	γ Pegasi	0	05	22.81	22.90	+0.09	"
"	d Piscium	0	12	44.47	44.84	+0.37	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.	Seconds of Tabular A. R.	Diff.	Observer's initial.
		h. m. s.	s.	s.	
1846, Oct. 5	61′ Cygni	21 00 03.60	03.47	—0.13	B[1]
"	ζ Cygni	21 06 26.54	26.41	—0.13	"
"	α Cephii	21 14 57.42	57.50	+0.08	"
"	α Andromedæ	0 00 30.85	30.72	—0.13	"
"	γ Pegasi	0 05 22.62	22.91	+0.29	"
"	ε Piscium	0 55 01.42	01.64	+0.22	"
"	☽'s 2d Limb	1 54 37.79			"
6	γ Ceti	2 27 51.71	51.98	+0.27	B[2]
"	μ^1 Ceti	2 36 41.43	41.34	—0.09	"
"	☽'s 2d Limb	2 53 22.73			"
"	δ Arietis	3 02 54.35	54.10	—0.25	"
"	α Persei	3 13 27.45	27.31	—0.14	"
"	ξ Tauri	3 18 53.53	53.79	+0.26	"
"	η Tauri	3 38 24.81	24.85	+0.04	"
7	δ Arietis	3 02 54.42	54.12	—0.30	"
"	α Persei	3 13 27.22	27.34	+0.12	"
"	ξ Tauri	3 18 53.73	53.81	+0.08	"
"	η Tauri	3 38 24.93	24.87	—0.06	"
"	☽'s 2d Limb	3 51 49.99			"
"	γ Tauri	4 11 06.16	06.01	—0.15	"
"	α Tauri	4 27 09.23	09.47	+0.24	"
11	ζ Geminorum	6 55 01.95	01.81	—0.14	"
"	δ Geminorum	7 10 58.72	58.62	—0.10	"
"	κ Geminorum	7 24 52.15	51.97	—0.18	"
"	☽'s 2d Limb	7 32 06.88			"
"	β Geminorum	7 35 56.28	56.38	+0.10	"
13	ε Hydræ	8 38 39.77	39.72	—0.05	B[1]
"	α Hydræ	9 20 03.45	03.39	—0.06	"
"	☽'s 2d Limb	9 10 49.26			"
"	α Leonis	10 00 12.08	12.18	+0.10	"
29	ι Aquarii	21 58 10.17	10.37	+0.20	"
"	ϑ Aquarii	22 08 45.45	45.59	+0.14	"
"	☽'s 1st Limb	22 31 53.36			"
"	λ Aquarii	22 44 38.48	38.33	—0.15	"
"	ϑ Aquarii	23 06 24.55	24.54	—0.01	"
"	α Pegasi	22 57 09.54	09.36	—0.18	"
"	α Andromedæ	0 00 30.81	30.66	—0.15	"
"	γ Pegasi	0 05 22.48	22.84	+0.36	"
Dec. 11	η Virginis	12 12 04.60	04.67	+0.07	"
"	☽'s 2d Limb	12 26 27.15			"
"	γ^1 Virginis	12 33 53.88			"
13	α Virginis	13 17 08.20	08.16	—0.04	"
"	☽'s 2d Limb	14 05 12.30			"
23	☽'s 1st Limb	22 53 32.08			"
"	λ Piscium	23 34 14.53	14.94	+0.41	"
"	ω Piscium	23 51 27.56	27.61	+0.05	"
"	γ Pegasi	0 05 22.25	22.29	+0.04	"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's Initial.
		h.	m.	s.	s.	s.	
1846, Dec. 23	d Piscium	0	12	44.42	44.27	−0.15	B[1]
26	α Pegasi	22	57	08.74	08.62	−0.12	"
"	γ Pegasi	0	05	22.36	22.25	−0.11	"
"	μ Piscium	1	22	11.42	10.98	−0.44	"
"	☽'s 1st Limb	1	39	18.62			"
30	α Tauri	4	27	10.84	10.61	−0.23	"
"	ι Tauri	4	53	59.09	59.12	+0.03	"
"	β Tauri	5	16	40.08	39.50	−0.58	"
"	α Orionis	5	46	55.11	55.24	+0.13	"
"	☽'s 1st Limb	5	24	58.19			"
"	ζ Tauri	5	23	32.09	32.08	+0.01	"
"	χ^5 Orionis	5	54	51.85	52.00	+0.15	"
1847, Jan. 5	π Leonis	9	52	09.08	09.02	−0.06	"
"	α Leonis	10	00	14.67	14.70	+0.03	"
"	☽'s 2d Limb	10	35	08.46			"
"	d Leonis	10	52	40.68	40.67	−0.01	"
"	χ Leonis	10	57	08.38	08.32	−0.06	"
22	☽'s 1st Limb	1	22	36.46			"
"	α Arietis	1	58	34.36	34.48	+0.12	"
23	η Piscium	1	23	19.02	18.84	−0.18	B[2]
"	γ^1 Arietis	1	45	09.52	09.31	−0.21	"
"	α Arietis	1	58	34.47	34.46	−0.01	"
"	☽'s 1st Limb	2	16	36.11			"
"	γ Ceti	2	35	23.66	23.62	−0.04	"
25	ξ Tauri	3	18	53.86	54.12	+0.26	B[1]
"	η Tauri	3	38	25.50	25.40	−0.10	"
"	λ Tauri	3	52	14.07	13.91	−0.16	"
"	☽'s 1st Limb	4	10	51.89			"
"	α Tauri	4	27	10.29	10.43	+0.14	"
27	ζ Tauri	5	28	32.00	32.02	+0.02	"
"	☽'s 1st Limb	6	02	12.94			"
"	γ Geminorum	6	29	54.32	54.23	−0.09	"
28	μ Geminorum	6	13	44.16	44.27	+0.11	"
"	γ Geminorum	6	28	54.18	54.22	+0.04	"
"	☽'s 1st Limb	6	56	21.77			"
"	δ Geminorum	7	11	00.95	01.01	+0.06	"
"	κ Geminorum	7	24	54.28	54.37	+0.09	"

Moon Culminations,

Observed at Cambridge Observatory, corrected for Collimation, Level, and Azimuthal Deviations of the Transit Instrument, and for Clock Rate and Error on Sidereal Time.

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's initial.
		h.	m.	s.	s.	s.	
1847, Jan. 31	ϰ Cancri	8	59	29.52	29.31	—0.21	B²
"	α Hydræ	9	20	06.28	06.20	—0.08	"
"	☽'s 2d Limb	9	30	42.49			"
"	ο Leonis	9	33	00.85	01.00	+0.15	"
"	ε Leonis	9	37	11.64	11.53	—0.11	"
"	α Leonis	10	00	15.22	15.21	—0.01	"
Feb. 8	☽'s 2d Limb	15	58	22.74			B¹
"	δ Ophiuchi	16	06	20.51	20.47	—0.04	"
"	Antares	16	20	02.70	02.77	+0.07	"
23	γ Tauri	4	11	06.74	06.38	—0.36	"
"	α Tauri	4	27	10.02	10.01	—0.01	"
"	ι Tauri	4	53	58.65	58.58	—0.07	"
"	Capella	5	05	25.72	25.58	—0.14	"
"	ζ Tauri	5	28	31.85	31.67	—0.18	"
"	☽'s 1st Limb	5	45	21.87			"
"	η Geminorum	6	05	40.13	40.35	+0.22	"
"	ζ Geminorum	6	13	43.83	43.99	+0.16	"
24	Capella	5	05	25.52	25.55	+0.03	"
"	β Orionis	5	07	12.30	12.36	+0.06	"
"	β Tauri	5	16	38.91	38.98	+0.07	"
"	δ Orionis	5	24	12.68	12.76	+0.08	"
"	ε Orionis	5	28	28.30	28.39	+0.09	"
"	η Geminorum	6	05	40.01	40.33	+0.32	"
"	μ Geminorum	6	13	44.12	43.96	—0.16	"
"	☽'s 1st Limb	6	39	42.76			"
"	ζ Geminorum	6	55	03.63	03.83	+0.20	"
"	δ Geminorum	7	11	00.90	00.83	—0.07	"
25	δ Geminorum	7	11	00.60	00.82	+0.22	"
"	α² Geminorum	7	24	52.33	52.02	—0.31	"
"	☽'s 1st Limb	7	32	23.56			"
"	β Geminorum	7	35	59.06	58.90	—0.16	"
"	φ Geminorum	7	44	09.45	09.80	+0.35	"
26	ζ Geminorum	6	55	04.00	03.81	—0.19	"
"	δ Geminorum	7	11	00.81	00.80	—0.01	"
"	α² Geminorum	7	24	52.02	52.00	—0.02	"
"	ϰ Geminorum	7	35	14.29	14.25	—0.04	"
"	☽'s 1st Limb	8	23	17.19			"
March 2	δ Leonis	11	05	59.90	59.89	—0.01	B²
"	σ Leonis	11	13	16.67	17.02	+0.35	"
"	τ Leonis	11	20	06.03	06.33	+0.30	"
"	☽'s 2d Limb	11	35	27.44			"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's Initial.
		h.	m.	s.	s.	s.	
1847, March 2	ν Virginis	11	38	01.62	01.82	+0.20	B^3
"	β Leonis	11	41	17.14	17.18	+0.04	"
"	β Virginis	11	42	45.58	45.91	+0.33	"
24	ζ Geminorum	6	55	03.28	03.35	+0.07	B^1
"	δ Geminorum	7	11	00.34	00.37	+0.03	"
"	☽'s 1st Limb	7	15	07.04			"
"	k Geminorum	7	24	53.82	53.79	—0.03	"
"	κ Geminorum	7	35	13.89	13.84	—0.05	"
"	Procyon	7	31	18.81	18.84	+0.03	"
25	α Orionis	5	46	54.33	54.37	+0.04	"
"	μ Geminorum	6	13	43.32	43.44	+0.12	"
"	k Geminorum	7	24	53.79	53.77	—0.02	"
"	Procyon	7	31	18.82	18.83	+0.01	"
"	κ Geminorum	7	35	13.99	13.82	—0.17	"
"	☽'s 1st Limb	8	06	49.81			"
"	ϑ Cancri	8	22	53.94	53.74	—0.20	"
"	δ Cancri	8	36	00.86	00.82	—0.04	"
April 24	α Hydræ	9	20	05.60	05.66	+0.06	"
"	ο Leonis	9	33	00.58	00 57	—0.01	"
"	α Leonis	10	00	14.89	14.97	+0.08	"
"	☽'s 1st Limb	10	15	11.72			"
"	ϱ Leonis	10	24	46.84	46.90	+0.06	"
27	π Virginis	11	53	04.08	04.13	+0.05	B^2
"	η Virginis	12	12	06.98	06.98	0.00	"
"	☽'s 1st Limb	12	34	39.08			"
"	δ Virginis	12	47	56.19	55.99	—0.20	"
"	ϑ Virginis	13	02	04.49	04.63	+0.14	"
"	α Virginis	13	17	10.80	10.97	+0.17	"
28	α Virginis	13	17	11.00	10.98	—0.02	B^1
"	☽'s 1st Limb	13	22	21.17			"
"	ζ Virginis	13	26	56.78	56.87	+0.09	"
May 6	α Cygni	20	36	14.58	14.65	+0.07	"
"	☽'s 2d Limb	20	43	41.48			"
"	ε Pegasi	21	36	41.63	41.55	—0.08	"
25	☽'s 1st Limb	13	03	50.68			"
"	61 Virginis	13	10	27.63	27.36	—0.27	"
"	α Virginis	13	17	10.89	10.92	+0.03	"
"	η Bootis	13	47	25.99	26.26	+0.27	"
"	α Bootis	14	08	43.58	43.39	—0.19	"
26	61 Virginis	13	10	27.44	27.36	—0.08	"
"	α Virginis	13	17	10.86	10.92	+0.06	"
"	☽'s 1st Limb	13	52	25.21			"
"	κ Virginis	14	04	47.30	47.24	—0.06	"
27	κ Virginis	14	04	47.36	47.24	—0.12	B^2
"	λ Virginis	14	10	53.27	53.34	+0.07	"
"	☽'s 1st Limb	14	43	00.33			"
June 21	☽'s 1st Limb	12	44	47.38			"

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabular A. R.	Diff.	Observer's Initial.
		h.	m.	s.	s.		
1847, June 21	α Virginis	13	17	10.65	10.72	+ 0.07	B[1]
"	η Bootis	13	47	26.07	26.06	— 0.01	"
July 1	ζ Pegasi	22	33	52.55	52.53	— 0.02	"
"	Fomalhaut	22	49	13.14	13.15	+ 0.01	"
"	α Pegasi	22	57	10.93	11.07	+ 0.14	"
"	☽'s 2d Limb	22	02	59.72			"
"	ϑ Aquarii	22	08	47.99	47.87	— 0.12	"
"	γ Aquarii	22	13	47.69	47.30	— 0.39	"
"	σ Aquarii	22	22	35.27	35.36	+ 0.09	"
"	λ Aquarii	22	44	40.22	40.25	+ 0.03	"
21	α^2 Libræ	14	42	28.04	28.07	+ 0.03	"
"	☽'s 1st Limb	14	50	54.57			"
23	α Serpentis	15	36	46.60	46.50	— 0.10	"
"	β^1 Scorpii	15	56	35.89	36.00	+ 0.11	"
"	α Scorpii	16	20	05.50	05.55	+ 0.05	"
"	☽'s 1st Limb	16	38	08.95			"
"	η Ophiuchi	17	01	39.70	39.75	+ 0.05	"
"	ϑ Ophiuchi	17	12	40.32	40.59	+ 0.27	"
24	η Ophiuchi	17	01	39.62	39.75	+ 0.13	"
"	α Herculis	17	07	43.09	43.14	+ 0.05	"
"	ϑ Ophiuchi	17	12	40.51	40.58	+ 0.07	"
"	☽'s 1st Limb	17	45	44.46			"
27	α^2 Capricorni	20	09	37.23	37.16	— 0.07	"
"	β Capricorni	20	12	27.93	28.18	+ 0.25	"
"	☽'s 1st Limb	20	37	13.05			"
"	☽'s 2d Limb	20	39	23.08			"
"	μ Aquarii	20	44	27.42	27.31	— 0.11	"
Aug. 20	☽'s 1st Limb	17	09	11.15			"
"	o Serpentis	17	32	51.97	52.15	+ 0.18	"
"	μ^1 Sagittarii	18	04	40.23	40.28	+ 0.05	"
21	4 Sagittarii	17	50	29.92			"
"	☽'s 1st Limb	18	06	40.02			"
"	ϱ^1 Sagittarii	19	12	51.07	51.47	+ 0.40	"
"	e^2 Sagittarii	19	33	49.29	49.42	+ 0.13	"
24	ζ Aquilæ	19	58	25.69	25.72	+ 0.03	"
"	δ Aquilæ	19	17	50.34	50.10	— 0.24	"
"	γ Aquilæ	19	39	02.23	02.34	+ 0.11	"
"	α Aquilæ	19	43	22.10	22.31	+ 0.21	"
"	β Aquilæ	19	47	51.20	51.09	— 0.11	"
"	☽'s 1st Limb	21	07	18.00			"
"	β Aquarii	21	23	33.37	33.58	+ 0.21	"
"	γ Capricorni	21	31	39.51	39.98	+ 0.47	"
"	μ Capricorni	21	45	00.29	00.29	0.00	"

Mr. Everett read a short paper on the number of primary planets belonging to our system which might be supposed to remain as yet undiscovered.

He stated that he had been "led more particularly to the inquiry by the striking remark of M. Leverrier (in the *Compte Rendu* for 5th October, 1846, p. 659) to this effect,—'that we may hope that, after thirty or forty years of observations of the new planet, we shall be able to use it, in its turn, for the discovery of that which follows it, in the order of distances from the sun. *And so on.* Unhappily we shall soon fall upon stars, invisible in consequence of their immense distance from the sun, but whose orbits eventually, in the lapse of ages, will be traced with great exactness by means of the theory of secular inequalities.' All calculations of this kind must, of course, take for granted that the law of gravitation exists and operates in the remote parts of the system as it does within the reach of our observations. The star 61 Cygni is usually regarded as the fixed star nearest to us, and this is placed by Bessel at the distance of 62,481,500,000,000 miles. Adopting the only supposition that we are able to make on this subject, viz., that our sun and the stars are bodies of equal size and density, we may conclude that the attraction of the sun extends over half the interval between the sun and 61 Cygni, that is, over a space of 31,240,750,000,000 miles. The law of the distances from the sun at which the planets succeed each other in our system is not known; but assuming Bode's law, or, still more simply, a geometrical progression, as that which comes near the truth in reference to all the known planets except the last discovered (regarding the asteroids as one planetary system), and we should have room for ten new planets, and nearly the eleventh, outside the orbit of Neptune."

Mr. Everett also read a letter from Professor Owen, of London, containing an approving notice of Dr. Meigs's paper on the generation of the opossum, and expressing a strong desire to receive, in behalf of the Hunterian Museum, specimens of the impregnated uterus of this animal, preserved in spirits.

"Female opossums killed between the 18th of February and the 6th of March would be likely to afford such specimens,—of which not one exists in the museums of London, nor, I believe, in Europe. The value of the specimen would be enhanced, if any of your young anat-

omists would, previously to immersing the animal in spirits, inject the abdominal aorta with size or gelatine, colored by vermilion.

"There is only one expression in Dr. Meigs's memoir in which I am not disposed to acquiesce, where he says 'it is not to be believed that a breathing, &c., mammifer can be developed independently of a placenta' (p. 329). I have met with so many unexpected exceptions to assumed general rules in the animal economy, so many proofs that the Creator operates by ways diversified infinitely beyond human calculation, as to adopt no scientific dogma whilst any means of testing it by observation remain untried. It would be most desirable that the female opossum should be sought for at the period shown by Dr. Meigs to be that when she would be most likely to have embryos in the uterus, and the nature of the connection between the mother and offspring be examined. A placenta may be defined as a vascular, villous, or cellular process from the outer surface of the chorion, interlacing with a similar process from the inner surface of the womb, and producing an adhesion of the chorion thereto difficult to be overcome, and often not without laceration. The presence of such an organ, simple or subdivided, would be easily determined in an opossum killed towards the latter period of her brief pregnancy, say from March 1st to 7th. The analogy between the condition of the new-born young in the kangaroo, in which no placenta is formed, and the opossum is so close, that, if I were to allow myself to anticipate what unbiased observation ought to decide, I should expect as close an analogy in the condition of the fœtal membranes and appendages."

Mr. Teschemacher exhibited some specimens of anthracite coal, containing what he supposed to be fossil seeds, as he had carefully decarbonized the internal substance of them, and by the assistance of the Oberhausser microscope belonging to Professor Agassiz, with a power of 700 diameters, had found it to be a mass of distinct cells. Some of these seeds were surrounded by impressions resembling spinous processes, which were uniform and symmetrical. He also stated, that lately discovered specimens had confirmed him in his opinion, that most of the appearances usually called *slickensides* in the anthracite coal were the external parts of large fossil plants; also, that the small, uniform striæ frequent in the coal, and which are sometimes found covering pieces of a conical form, are the

impressions of the vessels of vegetables, and were not caused by the action of sliding in the veins; he thought that no accidental sliding could produce such uniform marks on numerous specimens from various mines.

Mr. Teschemacher also exhibited some rhizomorphæ, found in the old chambers of coal-mines.

Professor Agassiz called the attention of the Academy to the importance of a complete investigation of the anatomy, the mode of life, and the embryology of the blind-fish of the Mammoth Cave (*Amblyopsis spelæus*). He thought there was an opportunity to settle, by actual experiment, the extent of physical influences in causing organized beings to assume their peculiar and distinctive characteristics in relation to the media in which they live. He doubted not that important inferences could be derived from these investigations with reference to the question, whether species have been created in the localities they inhabit and with special adaptation to the external circumstances in which they were first introduced, or whether these circumstances were acting as modifying influences upon fewer primitive types, which would thus be diversified and produce the successive changes evinced in the geological series. The experiments he would suggest are, first, an accurate and complete anatomical investigation, sufficiently minute to enable the observer to perceive the slightest changes which would occur; secondly, observations upon individuals of different ages brought to the light and kept for a long time, even through a series of successive generations, in these new circumstances; thirdly, a complete series of comparative embryonic investigations with recently laid ova, traced simultaneously in the dark and under the influence of moderate and of intense light, keeping especially in view the formation of the nervous system, and particularly that of the eyes. If there is an eye formed in the dark, ascertain when and how it disappears, as it is entirely wanting in the full-grown individuals, and again notice the differences in this respect between specimens growing under the influence of light.

DONATIONS TO THE LIBRARY,

FROM MAY TO NOVEMBER, 1847.

Proceedings of the Providence Franklin Society. No. 2. April, 1847. From the Society.

Silliman's American Journal of Science, for May, July, and Sept. From the Editors.

Alfred Smee. The Potato Plant, its Uses and Properties, together with the Cause of the present Malady. 8vo. London, 1846. From the Author.

Philosophical Transactions of the Royal Society of London. Part 4, for 1846. From the Royal Society.

Proceedings of the Royal Society. No. 66. From the Same.

Astronomical Observations made at Greenwich Observatory in 1844. 4to. London, 1846. From the Same.

Magnetical and Meteorological Observations made at Greenwich Observatory in 1844. 4to. From the Same.

Transactions of the Royal Irish Academy. Vol. XXI., Part 1. 4to. Dublin, 1846. Also, Proceedings. Vol. III., Parts 1 and 2. From the R. I. Academy.

Proceedings of the American Philosophical Society. Vol. IV., Nos. 36 – 38. From the Society.

Sir R. I. Murchison. Silurian Rocks, and their Associates, in Parts of Sweden. 8vo. pamph. London, 1847. From the Author.

Biot. Instructions Pratiques sur l'Observation et de la Mesure des Propriétés Optiques appellées Rotatoires. 4to. pamph. Paris, 1845. From the Author.

Proceedings of the Academy of Natural Sciences. Philadelphia. Vol. III., Nos. 8 – 10. From the Academy.

J. D. Dana. On the Origin of Continents. — Volcanoes of the Moon. — Geological Results of the Earth's Contraction. — Origin of the Grand Outline Features of the Earth. 8vo. pamphlets. (Extr. from Sill. Jour.) From the Author.

C. L. Bonaparte. Catalogo Metodico da Pesci Europei. 4to. pamph. Napoli, 1846. From the Author.

List of the Osteological Specimens in the British Museum. 18mo. London. From the British Museum.

Mémoires de l'Académie Royale des Sciences, Morales et Politiques, de l'Institut de France. Tom. I., II., 2^{me} Ser. 1837 – 9. Tom. III. 1841. 4to. Paris. From the Institute.

Annals of the Lyceum of Natural History, New York. Vol. IV., Nos. 10, 11. 8vo. 1847. From the Lyceum.

Flora, oder Allgemeine Bot. Zeitung. 7 Nos. 8vo. 1843–46. From the Bot. Society of Ratisbon.

Magnetische und Meterologische Beobachtungen zu Präg. 6–7ter Jahrg. 1845–6. 4to. Prague, 1846–7. From the Observatory of Prague.

Karl Kriel. Magnetische und Geographische Ortbestimmungen in Böhmen, Jahren 1843–5. 4to. Prague, 1846. From the Author.

Abhandlungen der Historischen Classe der Königl. Bayerschen Akademie der Wissenschaften zu München. Band IV., t. 3. 1846. —Abhand. der Philos.-Philolog. Cl. Band IV., t. 3. 1847. 4to. From the Royal Bavarian Academy.

Lasaulx. Ueber das Studium der Griechischen und Romischen Alterthümer. 4to. pamph. München, 1846. From the Author.

James P. Espy. Report on Meteorology to the Surgeon-General. 4to. pamph. Washington, 1843. From the Author.

Annual Reports of the Regents of the University of the State of New York, from 1846 to 1837 inclusive. 8vo. From the Regents.

Journal of the American Oriental Society. Vol. I., Part 3. 8vo. 1847. From the Society.

Sir John F. W. Herschel. Results of Astronomical Observations made during the Years 1834–8, at the Cape of Good Hope. 4to. London, 1847. From the Duke of Northumberland, by the Author.

Report of the Sixteenth Meeting of the British Association for the Advancement of Science, held at Southampton in 1846. 8vo. London, 1847. From the Association.

Two Hundred and ninety-ninth Meeting.

November 2, 1847. — MONTHLY MEETING.

The PRESIDENT in the chair.

Letters were read from the Rev. Dr. Whewell, and John C. Adams, Esq., of Cambridge University, in acknowledgment of their election as Foreign Honorary Members of the Academy; also from Professor Edward Robinson, of New York, as a Corresponding Member.

Mr. Bond communicated his observations, made at the Ob-

servatory of Harvard University, on the comet discovered on the 1st of October ult., by Miss Mitchell, of Nantucket.

Observations on Miss Mitchell's Comet of Oct. 1, 1847.

Cambridge Mean Solar Time.	Comet's. A. R.	Comet's. Dec.	Star of Comparison. A. R.	Star of Comparison. Dec.	No. of Comp	
1847, d. h. m. s.	h. m. s.	° ′ ″	h. m. s.	° ′ ″		
Oct. 7 7 56 31	17 10 56.2	+70 01 18	17 08 21.48	+65 54 11.8	2	ζ Draconis.
9 6 48 11	16 44 14.4	55 31 51	16 43 46.6	55 40 57	1	Arg. Zone, 13.
11 8 09 00	16 32 00.2	36 38 07	16 37 36.36	36 48 05.7	4	Hist. Cel., p. 78.
14 7 42 54	16 20 34.7	9 51 17	16 24 38.43	9 44 50.4	3	Bess. Zone, 162.
15 7 27 27	16 17 59	+2 36 13	16 19 18	+2 41 55	2	" " 89.
18 6 34 44	16 11 10.1	—13 18 49	16 10 16.8	—12 59 17.4	4	" " 252.

"From the 7th to the 14th inclusive, the differences of right ascension and declination were taken from the circles of the twenty-three-foot refractor; on the 15th and 18th, the micrometers of the five-foot equatorial were employed. It is remarkable, that, though the comet is distinctly seen with the naked eye, it disappears under the slightest illumination of the field of the latter instrument. Nothing resembling a nucleus is visible in either telescope.

"*Oct. 11th.* The comet shows a faint tail of two degrees in length in the comet-seeker of 4-inch aperture.

"*Oct. 15th.* The determinations of this evening are very indifferent.

"From the Observations on the 7th, 11th, 14th, and 18th, Dr. Peirce has computed the following elements.

Per. pass.,	Nov. $14^{d}.41323$, Greenwich M. S. T.	
" dist.,	0.3294495.	
Long. asc. node.,	190° 51′ 03″.6	Mean eq. of Jan. 1, 1847.
Long. per.,	274° 16′ 48″.8	Mean eq. of Jan. 1, 1847.
Inclination,	71° 55′ 27″.0	
Motion,	Retrograde.	

"Mr. G. P. Bond, from the observations of the 7th, 9th, and 11th, finds,—

Per. pass.,	Nov. 14.6935 Greenwich M. S. T.
" dist.,	0.3468
Long. asc. node,	191° 01′
Long. per.,	276 24
Inclination,	72 28
Motion,	Retrograde."

Mr. Bond also presented the following

OBSERVATIONS ON LASSELL'S SATELLITE OF NEPTUNE,

Made at Cambridge Observatory.

1847,
Oct. 25th, 7h. 45m. Satellite is south, preceding the primary, pos. 40°, dist. 15″.4.
" 27th, 7h. 30m. Satellite is north, following the primary, pos. 61° 30′, dist. 13″.7; mean of six observations, using the powers 300 and 1000.
" 28th, 7h. 45m. Satellite is north, following the primary, pos. 43° 15′, dist. 15″.0, being the mean of nine determinations; powers 400 and 1000.
Nov. 2d, 7h. 15m. Satellite is north, following, pos. 55° 50′, dist. 14″.0. Powers 400 and 1000.

"The above were taken with the illuminated wires of the micrometer of the great refractor. The angles of position are reckoned from the parallel of declination."

The President gave some account of the mountain ranges of North America, illustrated by Bauerkeller's embossed map; also of the different passes through which a canal has been thought practicable from the Atlantic to the Pacific Ocean, and of the difficulties which at present render improbable the execution of any such work.

Dr. Bigelow gave also an account of the past and present nomenclature of Pharmacology in Great Britain and in this country, by which it appeared that the practice of using a single word, whenever it is practicable, for the name of each substance derived from the vegetable kingdom, was first introduced in the American Pharmacopœia of 1820, — and that this simple form of nomenclature has been since adopted, with few changes, by the Royal Colleges of Physicians in London and Edinburgh, instead of the more complex names formerly employed by them.

Three hundredth Meeting.

November 10, 1847. — QUARTERLY MEETING.

The PRESIDENT in the chair.

Captain William H. Smyth, R. N., President of the Royal Astronomical Society, London, was chosen a Foreign Honorary Member of the Academy.

Professor Edward H. Courtenay, of the University of Virginia, Captain W. H. Swift, U. S. Engineers, and Professor C. M. Mitchell of Cincinnati Observatory, Ohio, were elected Corresponding Members.

Hon. Abbott Lawrence, Rev. George Putnam, D. D., and Charles G. Loring, Esq., were elected Fellows.

Dr. M. Wyman reported that the Committee on Ventilation were engaged in experiments for testing the relative efficiency of different kinds of ventilating apparatus in use, by measuring the velocity of the current of air made by their means to rise through tubes arranged for the purpose; this velocity being measured directly, by introducing chlorine gas into the base of the current, and noting the discoloration of paper wet with a solution of hydriodate of potash in starch suspended in the upper part of the tube.

Professor Peirce gave some account of his computation of the mass of Neptune from the motions of its satellite.

Three Hundred and first Meeting.

December 7, 1847. — Monthly Meeting.

The President in the chair.

The committee to whom was referred the "Programme for the Organization of the Smithsonian Institution," submitted to the Academy by the Secretary, Professor Henry, with his letter of the 30th September, made the following Report.

"Professor Henry is understood to be desirous of ascertaining the opinions of the scientific bodies of the country, on the subject of the proposed organization of the Smithsonian Institution; and the free expression of their views is wished by him.

"The interesting nature and high importance of this foundation, and the novel and peculiar circumstances attending its establishment, make it highly expedient, in the opinion of the committee, that every step taken in its organization should be deliberately considered. They

think it no more than just to express their satisfaction, that the control of the infant establishment has been placed in the hands of a Board of Regents of the highest intelligence, respectability, and weight of character; and in the wise selection made of the officers, on whom the active executive duties of the institution will devolve, the committee perceive a satisfactory pledge, as far as they are concerned.

"Professor Henry's *Programme* commences with 'general considerations, which should serve as a guide in adopting the plan of organization.' He points out the nature of the bequest, as made to the United States for the purpose of founding at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men. The bequest is, accordingly, for the benefit of mankind. The government of the United States is but a trustee to carry out this noble design. Even the people of the United States are interested only so far as they constitute one of the great families of the human race.

"The objects of the Institution are twofold; 1st, the increase, and 2d, the diffusion, of knowledge, — objects which, although frequently in a vague way confounded with each other (inasmuch as it often happens that knowledge is diffused by the same acts which increase it), are nevertheless logically distinct, and require to be separately regarded. No particular kind of knowledge is specified by the founder as entitled to the preference; all branches are entitled to a share of attention; and the order and degree in which they are cultivated must be decided by a wise regard to means and circumstances. Knowledge may be increased by various modes of encouraging and facilitating the discovery of new truths; it is diffused chiefly, though not exclusively, through the instrumentality of the press. The organization should be such as to produce results not within the province of the existing institutions of the country. It was, for instance, evidently not the design of the liberal founder to establish a collegiate institution, or a place of education; nor would it be wise to appropriate his bequest for such an object, already sufficiently attained by the ordinary resources of public and private liberality. Considering the novelty of the undertaking, it would be manifestly unwise to stake too much on the success of the first efforts. The organization should be such as to admit of changes and modifications under the light of experience. As several years have elapsed since the fund came into the possession of the United States, it seems no more than equitable that a considerable

portion of the accruing interest should be added to the principal, to make up for the loss of time. The committee consider this suggestion as perfectly reasonable, and trust it will receive the favorable consideration of Congress. Liberal as is the original bequest, the sum is but small compared with the great objects to be accomplished. This consideration suggests the absolute necessity of economy in any outlay on buildings and fixtures; in reference to which a prudent regard must be had, not merely to the first cost, but to the future expense of repairs, and the support of the establishment. Great care must be taken not to multiply the number of persons to be permanently supported by the Institution. A clear and settled idea of its organization and mode of operation must precede the adoption of a plan of building, lest, after the completion of a costly edifice, it should be found nearly or quite useless; or worse even than useless, by forcing a character upon the Institution which would not otherwise have been given it. All view to mere local arrangement or advantage should be discarded at the outset, in the management of a trust created for the benefit of mankind.

"Such, very slightly expanded in a few of the propositions, are the general considerations proposed by Professor Henry as guides in adopting a plan of organization. They command the entire assent of the committee; and none of them more so than those which refer to the necessity of strict economy in the expenditure of the fund on a building, and exclusion of undue regard to local ornament. It would not be difficult to point to a memorable instance, in a sister city of the Union, in which the most munificent bequest ever made for the purpose of education has been rendered comparatively unavailing, by the total disregard of these wise principles. It is an additional reason for observing them, that the attempt to erect a highly imposing building for local ornament will not only crush in the bud all hope of fulfilling the ulterior objects of the bequest, but will be almost sure to fail of a satisfactory result as far as the edifice itself is concerned.

"The Secretary's plan of organization in reference to the increase of knowledge is so accurately digested and so thoroughly condensed, that the committee think it would be best to quote his own words: —

"'To INCREASE KNOWLEDGE, it is proposed,

"'1. To stimulate men of talent to make original researches, by offering suitable rewards for memoirs containing new truths; and,

"'2. To appropriate annually a portion of the income for particular researches under the direction of suitable persons.'

"These methods of *increasing knowledge* are farther unfolded in the following 'Detail of the Plan' for that purpose.

"'I. *By stimulating researches.*

"'1. Rewards consisting of money, medals, &c., offered for original memoirs on all branches of knowledge.

"'2. The memoirs thus obtained to be published in a series of volumes in a quarto form, and entitled Smithsonian Contributions to Knowledge.

"'3. No memoir, on subjects of physical science, to be accepted for publication which does not furnish a positive addition to human knowledge; and all unverified speculations to be rejected.

"'4. Each memoir presented to the Institution to be submitted for examination to a commission of persons of reputation for learning in the branch to which the memoir pertains, and to be accepted for publication only in case the report of this commission is favorable.

"'5. The commission to be chosen by the officers of the Institution, and the name of the author, as far as practicable, concealed until a favorable decision shall have been made.

"'6. The volumes of the memoirs to be exchanged for the transactions of all literary and scientific societies, and copies to be given to all the colleges and principal libraries in this country. One part of the remaining copies may be offered for sale; and the other carefully preserved, to form complete sets of the work, to supply the demand from new institutions.

"'7. An abstract or popular account of the contents of these memoirs should be given to the public through the annual report of the Regents to Congress.

"'II. *By appropriating a portion of the income annually to special objects of research, under the direction of suitable persons.*

"'1. The objects and the amount appropriated to be recommended by Counsellors of the Institution.

"'2. Appropriation in different years to different objects; so that in course of time each branch of knowledge may receive a share.

"'3. The results obtained from these appropriations to be published with the memoirs before mentioned in the volumes of the Smithsonian Contributions to Knowledge.

"'4. Examples of objects for which appropriations may be made:—

"'(1.) System of extended Meteorological Observations for solving the problem of American Storms.

"'(2.) Geological, Magnetical, and Topographical surveys to collect materials for the formation of a Physical Atlas of the United States.

"'(3.) Solution of experimental problems; such as weighing the earth; new determination of the velocity of electricity and of light; chemical analysis of soils and plants; collection and publication of articles of science, accumulated in the Offices of Government.

"'(4.) Institution of statistical inquiries with reference to physical, moral, and political subjects.

"'(5.) Historical researches and accurate surveys of places celebrated in history.

"'(6.) Ethnological researches, particularly with reference to the present races of men in North America; also explorations and accurate surveys of the mounds and other remains of the ancient people of our country.'

"The committee have made this long extract from Professor Henry's *Programme*, in order to give to the Academy an adequate idea of the proposed plan, as far as it refers to the first branch, or the *Increase of Knowledge*. It has, in some of its features, been already adopted. It is already announced that one voluminous memoir, copiously illustrated by engravings, is already on its passage through the press, under the auspices of the Smithsonian Institution. The committee refer to an elaborate memoir by Messrs. Squiers and Davis, on the aboriginal mounds discovered in large numbers in various parts of the United States, and especially in the region northwest of the Ohio. This memoir was accepted on the favorable report of the Ethnological Society of New York, to which it had been referred by the Secretary of the Institution, and in whose Transactions an abridgment of it has appeared. It is also understood that a memoir on one of the most interesting subjects which engages the attention of geometers and mathematicians at the present moment, viz. the planet Neptune, has been invited by the Secretary from one of our members.

"While the committee would deprecate all attempts unduly to stimulate the increase of knowledge, as sure to prove abortive, and to result at best in the publication of crude investigations, they believe it quite possible to remove some of the obstructions to its progress. Narrow circumstances are too apt to be the lot of genius when devoted to scientific pursuits; and the necessity of providing for personal and

domestic wants too often absorbs the time and faculties of those who might, if relieved from cares of this kind, have adorned their age and benefited mankind. To such men a moderate pecuniary advantage, derived from a successful investigation, might be of vast importance. The efficacy of market upon production is not limited to the creations of physical labor. It is seen in the history of science and literature of every age and country. Invention in the mechanical arts, and skill in practical science, are well paid in this country, and how great is the harvest! The extraordinary effect even of an honorary inducement is seen in the case of the medal offered by the king of Denmark for the discovery of telescopic comets. On these principles it may be hoped, that, by offering a moderate pecuniary compensation for researches of real merit, valuable contributions to knowledge will be produced; while their publication will tend directly to the diffusion of knowledge. An encouragement somewhat similar, toward the promotion of the increase of knowledge, would be afforded by another part of the proposed operations, that of providing the requisite apparatus and implements, and especially books, to be placed in the hands of those engaged in particular lines of investigation. In this way it is not unlikely that a considerable amount of talent may be rendered effective, which at present is condemned to inactivity from local position unfavorable to scientific research.

"It is not the purpose of the committee to engage in minute criticism of the details of the *Programme;* but it may not be out of place to suggest a doubt of the practicability or expediency of carrying into rigid execution 'the rejection of all unverified speculations,' as proposed in the third paragraph of the first section above cited. While it is obviously advisable to discountenance all theoretical speculations not directly built upon observation, it might be too much to exact, in all cases, that these speculations should have been actually verified. No small portion of modern geology is an ingenious structure of speculative generalizations. The undulatory theory of light can hardly claim any other character. The nebular theory, though proposed and illustrated by the highest astronomical talent of the past and present generations, is rapidly sinking from the domain of accredited speculations. It may be doubted even whether M. Leverrier's brilliant memoirs on the perturbations of Uranus would not, as published before the discovery of Neptune, have fallen within this principle of rejection rigorously applied.

"Upon the whole, the committee think very favorably of all parts of the plan for increasing knowledge, and feel no doubt that it would afford important encouragement to scientific pursuits. To suppose that it will create an era in science, or throw into the shade the ordinary educational and intellectual influences at work in the country, would be extravagant. It is enough, and all that can be expected, if it be a rational plan for appropriating moderate means toward the attainment of a desirable end.

"To fulfil the other objects of the trust, viz. to 'diffuse knowledge,' the Secretary proposes to publish 'a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge not strictly professional.' These reports are to be prepared by collaborators most eminent in their several departments, who are to receive a compensation for their labors; the collaborator to be furnished with all the journals and other publications necessary to the preparation of his report.

"The following enumeration of the proposed subjects of these reports will give the Academy a full conception of this part of the plan.

"'I. PHYSICAL CLASS.

"'1. Physics, including Astronomy, Natural Philosophy, Chemistry, and Meteorology.

"'2. Natural History, including Botany, Zoölogy, and Geology.

"'3. Agriculture.

"'4. Application of Science to Arts.

"'II. MORAL AND POLITICAL CLASS.

"'5. Ethnology, including Particular History, Comparative Philology, Antiquities, &c.

"'6. Statistics and Political Economy.

"'7. Mental and Moral Philosophy.

"'8. A Survey of the Political Events of the World; Penal Reform, &c.

"'III. LITERATURE AND THE FINE ARTS.

"'9. Modern Literature.

"'10. The Fine Arts, and their application to the useful arts.

"'11. Bibliography.

"'12. Obituary notices of distinguished individuals.'

"Another branch of the plan for the diffusion of knowledge contemplates the offer of premiums for the best essays on given subjects.

"The publications of the Institution, of whatever form, are proposed to be presented to all the colleges and to the principal libraries and scientific institutions throughout the country, and to be exchanged for the transactions of all scientific and literary societies throughout the world, thus laying the foundation of a valuable library. An adequate number are to be preserved to supply the future demand of new institutions, and the remainder are to be placed on sale at a price so low as to render them generally accessible.

"For carrying out the plan thus sketched for increasing and diffusing knowledge, the Regents propose to appropriate one half of the income of their fund. The remainder is to be expended in the formation and maintenance of *a library*, *a collection of instruments of research in all branches of experimental science, and a museum.* This partition of the income of the fund is stated to be 'a compromise between the two modes of increasing and diffusing knowledge.'

"A library is one of the objects contemplated in the act of Congress, establishing the Board for the management of the trust. It is requisite for carrying out the plan above proposed. At the same time it will be observed, that the distribution by exchange of the publications, which that scheme of operations will call into existence, will rapidly provide the Institution, without farther expense, with the class of works, often of a costly character, which are most directly important as the means of advancing and diffusing positive knowledge. It is accordingly in these that the Secretary proposes to lay the foundations of the library; forming, 1st, a complete collection of the Transactions and Proceedings of all the learned societies in the world; and, 2d, a similar collection of all the current periodical publications, and other works necessary in preparing the contemplated periodical reports. In the next place, it is proposed to procure by preference those books which are not found in the other public libraries of the United States, regarding the want of them as of more urgency to be supplied than that of a symmetrical and proportionate collection of books in all the departments of science. Such a library as the plan proposes may be fairly regarded as an important instrument for the increase and diffusion of knowledge.

"The collection of scientific apparatus and instruments of research is no less needful in the furtherance of the above-mentioned plan,

which, as it proposes to aid individuals in the prosecution of important researches, may often do so most effectually by the loan of the instruments required for a particular investigation. They will also be needed, especially at Washington, for carrying out, under the most advantageous circumstances, the various experimental investigations in physics already pursued by the Secretary, with such credit to himself, and such honor to the scientific character of the country.

"The Smithsonian Institution is also to be intrusted with the conservation of a national museum; Congress having, by a clause in the act of incorporation, devolved upon it the charge of the immense collections belonging to the public, of which those brought home by Captain Wilkes from the Exploring Expedition form the greater portion, but which are daily increasing from many sources. These collections, when a proper and convenient place shall have been prepared for their reception and preservation, are likely to accumulate with still greater rapidity in time to come.

"While there is an obvious propriety and convenience in thus intrusting the care of the public collections to the officers of the Smithsonian Institution, it will not, the committee trust, be forgotten by Congress, that the income of the Smithsonian bequest — moderate at best, and consecrated to an object distinct as it is elevated — ought not to be burdened with the cost of constructing an edifice for the reception and exhibition of the public collections, and their preservation and care. These objects would alone absorb a considerable portion of the fund. If drawn upon to carry them into effect, its efficiency for any other purpose will be seriously diminished, if not altogether destroyed.

"The plan also contemplates a museum of the fine arts, as well as a scientific apparatus; it proposes to procure 'casts of the most celebrated articles of ancient and modern sculpture,' and 'models of antiquities.' While it is undoubtedly true, that a gallery of this description would find an appropriate place in an establishment devoted to the increase and diffusion of knowledge in its broadest sense, the committee cannot but hope that the immediate execution of this part of the plan will not be attempted; but that it will be deferred till other objects of more decided utility have been provided for, and until a surplus of unappropriated funds shall have accrued.

"The Academy will perceive that the most novel and important feature of this plan is that which proposes to insure the publication of

memoirs and treatises on important subjects of investigation, and to offer pecuniary encouragement to men of talent and attainment to engage in scientific research. It is believed that no institution in the country effects either of these objects to any great extent. The nearest approach to it is the practice of the Academy, and other philosophical societies, of publishing the memoirs adopted by them. These, however, can rarely be works of great compass. No systematic plan of compensation for the preparation of works of scientific research is known by the committee to have been attempted in this or any other country. It can scarcely be doubted that an important impulse would be given by the Institution, in this way, to the cultivation of scientific pursuits; while the extensive and widely ramified system of distribution and exchange, by which the publications are to be distributed throughout the United States and the world, would secure them a circulation which works of science could scarcely attain in any other way.

"It is an obvious characteristic of this mode of applying the funds of the Institution, that its influence would operate most widely throughout the country; that locality would be of comparatively little importance as far as this influence is concerned; and that the Union would become, so to say, in this respect, a great school of mutual instruction.

"The committee would remark, in conclusion, that, in a plan of operations of this kind, very much depends upon the activity and intelligence with which it is administered. The character of the Board of Regents is a sufficient warrant for the prudence and good judgment which will watch over the general interests of the foundation; while the reputation of the Secretary and his assistant, the Librarian, is so well established in their respective departments, as to render any tribute from the committee entirely superfluous.

"All which is respectfully submitted by the committee.

EDWARD EVERETT, (*Chairman*,)
JARED SPARKS,
BENJAMIN PEIRCE,
HENRY W. LONGFELLOW,
ASA GRAY.

"*December* 4*th*, 1847."

NOTE. — "Professor Agassiz was named of the committee, but, owing to his absence at the South, was unable to take part in the preparation of this report."

Mr. Tuckerman communicated the following arrangement and description of the Lichenes of the northern portion of North America, viz.: —

*A Synopsis of the Lichenes of the Northern United States and British America,** *by* EDWARD TUCKERMAN.

LICHENES.

Perennial, aerial Algæ, vegetating only under the influence of moisture, which is imbibed by the whole surface, propagated by spores (*sporidia*), and also by the cells (*gonidia*) of the green layer.

Thallus (universal receptacle, *Ach.*) composed of three layers, viz.: the *cortical*, the *medullary*, and the *gonimous;* evolved from a *hypothallus* (the elementary state in which the layers are confused, and discernible afterwards as cylindrical cells, and also as fibres on the under side of foliaceous Lichenes, and forming the base, closely adnate to the matrix, in crustaceous ones), typically horizontal or vertical. The horizontal thallus is either *crustaceous* (often somewhat lobed at the circumference or squamulose), or *foliaceous* (becoming sometimes in degenerate states crustaceous). The vertical thallus is either compressed (*subfoliaceous*), or terete (*fruticulose*); of both of which the *filamentous* thallus and the *pendulous* thallus are degenerations. In Cladonia and Stereocaulon a vertical thallus (*podetium*) arises from the primary horizontal thallus, and is itself often besprinkled with a kind of secondary horizontal thallus in the form of leaf-like scales. — Lichenes are reproduced in two ways; 1. by *gonidia*, the (normally green) cells of the green (gonimous) layer, which appear on the surface as irregularly shaped powdery masses (*soredia*), and propagate either on the original thallus, forming foliaceous or squamulose

* This enumeration, originally prepared for Dr. Gray's *Manual of the Botany of the Northern States*, has been enlarged by the addition of many species from Arctic America, and from the Pacific coast, and is now published in the hope that it may open the way to a more complete and satisfactory account hereafter. The system is that of Fries, as presented in his *Lichenographia Europæa Reformata*, with some emendations derived from his later works. The characters of the sections and genera in the *Lichenographia* have been throughout the basis of those here given, and in part are adopted entire. In the citation of authorities for specific names, the common usage has been followed; but the writer has elsewhere adopted what appears the preferable one (*Enum. Lich. N. Amer.* 1845), where will also be found some account of the Friesian System.

expansions, or external to the original thallus, forming new individuals of the parent thallus; and 2. by *sporidia*, consisting of subglobose or elliptical cells, which are either naked or contained in other elongated more or less vertical cells (*asci*), and immersed in the *thalamium* (or fructification proper), and propagate new individuals of the species. The thalamium is either rounded, gelatinous-waxy, and the asci converging (*nucleiform*); or flattened at length into a rigid, persistent, or afterwards collapsing lamina (*subdisciform*); or originally disciform (*open*); and is itself contained in a receptacle (*exciple*), either of the same color with and like the thallus (*thalline exciple*), or of different color and nature (*proper exciple*). The whole fructification constitutes the *apothecium*, which is typically round, though also occurring normally oblong and linear (*lirellæform*), and is either excavated with a contracted margin (*urceolate*); or slightly concave with an elevated margin (*scutelliform*); or very concave-scutelliform (*cyathiform*); or very concave-scutelliform and pervious (*infundibuliform*, a term applied also to the pervious cup-bearing podetia of Cladoniæ); or goblet-shaped and stipitate (*crateriform*); or dilated, flat, and without prominent margin (*peltæform*, of which the *reniform* is a variation); or convex with repressed margin (*cephaloid*); or between scutelliform and peltæform (*disciform*); or between scutelliform and cephaloid (*tuberculate*). When the thalline exciple is prolonged below into a footstalk, it is said to be *pedicellate;* a proper exciple in like manner prolonged is said to be *stipitate*. When the proper exciple is originally and typically closed, the apothecium receives the name of *perithecium*. In the Angiocarpi several thalamia are sometimes contained in the same exciple (*composite apothecia*); and in the Gymnocarpi, in like manner, several disks are sometimes confluent (*symphycarpeous apothecia*). The colors of the thallus in Lichenes are disposed by Fries in four series: — 1. from pale green becoming *glaucous;* 2. from yellowish green becoming *ochroleucous;* 3. from dark green becoming *fuscous* or *olivaceous;* 4. from pale yellow-green becoming *lemon-colored*. Each series has its peculiar variations. The glaucous runs into pale green, cerulescent, and white; the fuscous into dark green, olivaceous, cinereous, grayish-fuscous, and dark chestnut; the ochroleucous into yellowish green and albescent; the lemon-colored into pale yellow, orange-red, and vermilion-red.

Synopsis of the Genera.

Div. I. GYMNOCARPI, Schrader, Fries.

Apothecia open, disciferous. Thalamium originally disciform, or becoming so, contained in a thalline exciple or a proper exciple; disk normally persistent, ascigerous; sometimes originally pulveraceous-collapsed.

Tribe I. PARMELIACEÆ, Fr. — Apothecia rounded, from concave becoming explanate, scutelliform, rarely peltate. Disk somewhat waxy, persistent, contained in a thalline exciple.

Subtribe 1. Usneeæ, Eschw. — Disk open. Thallus subvertical, or pendulous-sarmentose, centripetal, without apparent hypothallus.

1. Usnea. Apothecia peltate; thallus with a solid medullary layer.
2. Evernia. Apothecia scutelliform; thallus fistulous, or with a cottony medullary layer.
3. Ramalina. Apothecia orbiculate-subpeltate; disk pale, of nearly the same color with the thallus.
4. Cetraria. Apothecia scutellate-peltate, oblique.

Subtribe 2. Parmelieæ, Eschw. — Disk at first closed, becoming at length discoid-open. Thallus horizontal, centrifugal, with a hypothallus.

5. Nephroma. Apothecia reniform, adnate to the under side of the lobes.
6. Peltigera. Apothecia peltæform, adnate to the upper side of the elongated lobes.
7. Solorina. Apothecia maculæform, adnate to the disk of the thallus.
8. Sticta. Apothecia scutelliform; thallus with cyphellæ, or discolored spots, on the under side.
9. Parmelia. Apothecia scutelliform; thallus without veins or cyphellæ beneath.
10. Thelotrema. Apothecia urceolate-scutelliform, a discrete interior exciple veiling a rigescent disk.
11. Gyalecta. Apothecia urceolate, an elevated and discrete colored margin bordering a nigrescent disk.

Tribe II. LECIDEACEÆ, Fr. Apothecia rounded, a persistent

disk contained in an open proper exciple, which it finally covers, and becomes convex, cephaloid, and immarginate.

12. STEREOCAULON. Apothecia turbinate, at length cephaloid; podetia mostly solid.

13. CLADONIA. Apothecia at length cephaloid, inflated; podetia fistulous.

14. BÆOMYCES. Apothecia capitate, globose, immarginate, velate.

15. BIATORA. Apothecia disciform, solid, with a waxy (originally paler) exciple.

16. LECIDEA. Apothecia disciform, solid, with a carbonaceous, black proper exciple.

Tribe III. GRAPHIDACEÆ, Fr. — Apothecia of various form, an altered thalline carbonaceous proper exciple, or an originally proper exciple margining a gyrose and proliferous-papillate, or canaliculate disk.

17. UMBILICARIA. Apothecia orbiculate or lirellæform; thallus foliaceous.

18. OPEGRAPHA. Apothecia lirellæform; thallus crustaceous.

19. LECANACTIS. Apothecia irregular, at first open, with a pruinose thalline veil.

Tribe IV. CALICIACEÆ, Fr. — Apothecia orbiculate or globose, always open, margined by a proper exciple, the disk collapsing into naked sporidia; or without an exciple; the sporidia capituliform-compact.

20. TRACHYLIA. The carbonaceous exciple innate, with an ascigerous disk.

21. CALICIUM. The carbonaceous exciple free; disk compacted of naked sporidia.

22. CONIOCYBE. Exciple wanting; sporidia capituliform-compact.

Div. II. ANGIOCARPI, Schrader, Fries.

Apothecia closed, nucleiferous, pertuse and with an ostiole, or irregularly dehiscent; the nucleus included, subglobose, ascigerous.

Tribe I. SPHÆROPHORACEÆ, Fr. — Apothecia formed of the intumescent apices of the thallus, closed, at length irregularly lacerate-dehiscent. Nucleus subglobose. Thallus vertical, fruticulose.

23. Sphærophoron. Apothecia terminal, spherical; nucleus black, dehiscent.

Tribe II. ENDOCARPACEÆ, Fr. — Apothecia immersed in the thallus, globose, the thalline exciple attenuated into a neck, and terminated by a discrete heterogeneous papillæform ostiole. Nucleus deliquescent. Thallus horizontal, foliaceous or crustaceous.

24. Endocarpon. Apothecia pale, included in the foliaceous thallus.
25. Sagedia. Apothecia blackish, immersed in the crustaceous thallus.
26. Pertusaria. Apothecia verrucæform, with one or more blackish, papillate ostioles.

Tribe III. VERRUCARIACEÆ, Fr. — Apothecia rounded, a closed proper exciple (perithecium) becoming pertuse with an ostiole, or at length open. Nucleus gelatinous, subhyaline, deliquescent. Thallus crustaceous.

27. Conotrema. Perithecia at length open; nucleus subdisciform.
28. Verrucaria. Perithecia closed, with a papillæform or simply pertuse ostiole.

Tribe IV. LIMBORIACEÆ, Fr. — Apothecia rounded, the carbonaceous proper exciple closed, at length variously dehiscent. Nucleus subceraceous, rigescent. Thallus crustaceous.

29. Pyrenothea. Perithecia at length pertuse, protruding the fatiscent nucleus.

I. USNEA, Dill., Hoffm.

Apothecia rounded, peltate, subterminal; disk open, placed upon the filamentous medullary stratum, the margin mostly radiate-ciliate. Thallus cartilagineous, at first erect, suffruticulose, becoming with age more or less filamentous or pendulous, the crustaceous cortical stratum somewhat separate from the medullary.

A genus universally diffused; and the first species occurring, in one or other of its forms, in every quarter of the globe. This species extends throughout the United States. *U. homalea*, Tuckerm. Enum. 1845, with a softish, much compressed, ancipital, rugulose, fastigiate and attenuate-branched thallus, and plane apothecia, with scarcely elevated, obtuse margins, *Ramalina homalea*, *Ach. Lich. p.* 598, was discovered on the coast of California by *Menzies!* but has not been detected elsewhere.

1. U. *barbata*, Fr. Thallus terete, irregularly branched, at length annulate-cracked, glaucous; apothecia almost immarginate, radiate, disk pale. *Fr. Lichenogr. p.* 18. — *α. florida*, Fr., very much branched, somewhat scabrous, apoth. large. *U. florida, Ach.* — *β. strigosa*, Ach., rather small, very thickly fibrillose-strigose. *Ach. Syn. p.* 305. — *γ. rubiginea,* Michx., lax, scabrous, more or less rusty-red. *U. florida, var. rubiginea, Michx. Fl.* 2, *p.* 332. — *δ. hirta*, very much branched, dwarfish, the fibrillæ somewhat elongated, oftener verrucose-pulverulent. *U. hirta, Hoffm.* — *ε. plicata*, Fr., pendulous, elongated, subdichotomous, entangled, lax, smoothish, pale. *U. plicata, Ach.* — *ζ. dasypoga*, Fr., pendulous, elongated, branches somewhat simple, lateral fibres spreading. *U. barbata, Hoffm. Lichen barbatus, L.*

Very common; *α*, *β*, *ε*, and *ζ* mostly on trees, the last two less frequently fertile; *δ* on rails, sterile; New England. New York, *Torrey*. Pennsylvania, *Muhl.* Northward to Arctic America, *Richardson* (Franklin's Narrative, App.).

2. U. *longissima*, Ach. Th. pendulous, filamentous, terete-compressed, somewhat rugulose, smoothish, nearly simple, pale glaucous, with approximate, horizontal, at length tortuous fibres. *Ach. Syn. p.* 307.

Firs and other trees on the sides, and in swamps at the base, of the high mountains of New England, and northward, occurring 5 feet long. Infertile, as is also the case with the European Lichen on which the species was founded. It seems, like the last species, to be very widely diffused; and I have, or have seen, specimens probably belonging to it, from Europe, Asia, Africa, and New Holland. A single Cape of Good Hope specimen, in my possession, is fertile, and has quite concave radiate apothecia, with somewhat elevated, obtuse margins. The earliest specimen I have seen is an infertile one in the Berlin herbarium, collected in Cappadocia by Tournefort.

3. U. *angulata*, Ach. Th. pendulous, flexuous, angular, nearly simple, pale cinerascent; angles acute, scabrous; fibres horizontal approximated, simple, short, terete-attenuate. *Ach. Syn. p.* 307. *Halsey, Lich. New York, in Ann. Lyc.* 1, *p.* 21.

Trees, Pennsylvania, *Muhl.*, *Ach.* New York, *Torrey.* Massachusetts, occurring 4 feet long, *Halsey.* Spruce swamps, Chelmsford, *Russell!*

4. U. *trichodea*, Ach. Th. pendulous (prostrate), very delicate

and flexile, filiform, smooth, somewhat branched, whitish-pallescent; fibres horizontal, scattered, rather secund, flexuous; apoth. small, with an elevated, thin, entire margin. *Ach. Syn. p.* 307. Icon, *Ach. Meth.*, *t.* 8, *f.* 1.

Nova Scotia, *Menzies*, fide Ach. Canada, *Herb. Michaux!* The specimen in herb. Floerk.! which Floerke supposed might be U. trichodea, Ach., is referred by him to U. plicata.

5. U. *sphacelata*, R. Br. Th. erectish, fruticulose, the principal branches ochroleucous, black-vittate, smooth, the ultimate ones attenuate, black, all sorediiferous. *R. Br. Suppl. to Parry's Voy. p.* 307.

Melville Island, *R. Br.* I have not seen American specimens, but I have received fine ones from Dr. Vahl, collected by him in Spitzbergen.

II. EVERNIA, Ach., Fr.

Apothecia rounded, scutelliform, marginal; disk open, placed upon the cottony medullary layer, colored. Thallus originally erect, teretish-fruticulose or compressed-foliaceous (abnormally filamentous or pendulous), within uniform, and either fistulous, or filled with the cottony medullary layer.

The third section of this genus (Physcia) is further represented in the South of Europe by three species not as yet known with us:— *E. intricata*, Fr., with a much-branched, linear, glaucous thallus; *E. villosa*, Fr., with a villous, multifid, glaucous thallus; and *E. flavicans*, Fr., with a much branched, linear, bright yellow thallus; of which the first and last species attain to the southern coast of England (Borrer); the first two are found in the Canary Islands (Montagne); the second in Peru (Acharius); and the last in the West Indies (Ach.) and South America (Eschweiler). It is possible that one or more of these species may occur in the Southern States. In the North, *E. divaricata*, Ach., nearest to E. prunastri, with a more or less filamentous, softish, lacunose thallus, is the only European Lichen of the present section that is wanting with us.

§ I. *Cornicularia*, Fr. Fruticulose, passing into filamentous or pendulous forms.

1. E. *furcellata*, Fr., with long (terete-compressed?) di-trichotomously divided, suberect, entangled branches, from hoary becoming cinereous, or slightly greenish, with furcate fuscous apices, *Dill. Musc. t.* 85,

f. 14, was constituted on a Lichen which Fries referred to this figure and description of Dillenius, whose own specimens were sent him from Pennsylvania, by *J. Bartram.* I have not seen Fries's description, but he says incidentally (Lichenogr. p. 478) that his specimens are (like those of Dillenius) infertile, and that the genus of the Lichen is therefore doubtful.

2. E. *jubata*, Fr. Thallus terete, smooth, much branched, black-fuscous (or palish), apices simple; apothecia innate-sessile, entire, of the same color with the thallus. *Fr. Lichenogr. p.* 20. — *α. bicolor*, Fr.; th. erectish, fruticulose, branches divergent, apices cinereous-fuscescent. *Cornicularia bicolor, Ach.* — *β. chalybeiformis*, Ach.; th. subfilamentous, decumbent, somewhat rigid, divergent (often white-sorediiferous), apices oftener palish. *Alectoria jubata, var. chalyb., Ach. Cornicularia fibrillosa, Halsey, Lich. N. Y. l. c. non Ach.* — *γ. implexa*, Fr.; th. filamentous, pendulous, very much branched, entangled, softish, apices of the same color. *Lichen jubatus, L.* — *δ. setacea*, Ach.; th. filamentous, rather slender, very long, pendulous, somewhat simple, frequently sorediiferous. *Alect. jubata, var. setacea, Ach. Setaria trichodes, Michx. Alect. trichodes, Pylaie Voy. p.* 17.

Very common: *α*, trees on high mountains, fertile; and on the ground in alpine districts, infertile; White Mountains. Arctic America, *R. Br.* (Ross's Voy.). — *β*, old rails, stones, and trees, sterile; common in New England. Arctic America, *R. Br.* (Scoresby's Arc. Regions), *Rich.* — *γ*, trees in mountainous and subalpine districts, infertile; New England and westward. Arctic America, *Rich.* — *δ*, dead wood, Canada, *Michaux!* Newfoundland and northward, *Herb. Hook.!* Michaux's Lichen is extremely delicate, but apparently not distinct.

3. E. *divergens*, Fr. Th. somewhat angular, dark-chestnut, white-dotted; branches elongated, flexuous; apices attenuated, forked, of the same color; apoth. innate-sessile, crenulate, disk of the same color. *Fr. Lichenogr. p.* 21. *Cornicularia, Ach.*

On the earth, alpine and arctic regions. Newfoundland, *Herb. Delessert.* Bear Lake, *Rich.*, *Hook.!* (Parry's Sec. Voy.).

4. E. *ochroleuca*, Fr. Th. teretish, smoothish, ochroleucous (and palish), axils compressed-sublacunose, irregularly branched, apices attenuate, subfibrillose; apoth. innate-sessile, at length repand, disk livid-fuscous. *Fr. Lichenogr. p.* 22. — *α. rigida*, Fr.; th. suberect, fruticulose, rigid, ochroleucous, apices reflexed, blackish. *Cornic. ochro-*

leuca, Ach. — *β. sarmentosa*, Fr.; th. filamentous, sarmentose-pendulous, much branched, softish, ochroleucous or pale, apices elongated, of the same color. *Alectoria sarmentosa, Ach.*

Mountainous, alpine, and arctic regions. — *α*, on the earth; White Mountains, infertile. Arctic America, *Rich.* (Herb. Hook. !), *R. Br.* (Parry's First Voy.), fertile. — *β*, on the trunks and branches of trees in the mountains of New England, and northward, fertile; and on the earth, alpine and arctic, sterile. *α* does not seem to be well represented on our mountains. The arctic specimens are very fine.

5. E. *vulpina*, Ach. Th. much branched, rigid, angular, compressed-lacunose, greenish-yellow; apoth. sessile, disk fuscous. *Fr. Lichenogr. p.* 23.

Trunks and rails, N. W. America, *Menzies!* and Rocky Mountains, *Herb. Hook.!* fertile. A few specimens in my possession, from the White Mountains, and elsewhere, may belong to this; but most of the degenerate plants commonly referred to it here are, perhaps, as safely placed with E. prunastri.

§ II. *Dufourea*, Fr. Fruticulose, inflated, apothecia terminal.

6. E. *ramulosa*, Hook. (sub Dufourea). Th. cæspitose, terete-compressed, scarcely lacunose, fuscous-glaucescent, much branched and fuscous-olivaceous above; branches subdichotomous, tuberculate-ramulose, obtusish. *Dufourea ramulosa, Hook. App. to Parry's Sec. Voy. p.* 424.

Arctic America, *Hook.* Considered by Hooker nearest to E. madreporiformis, from which he remarks that it differs in color, in its branching, and in being fistulous.

7. E. *arctica*, Rich. (sub Dufourea). Th. somewhat cæspitose, subsimple, or with a few short branches above, subulate-ventricose, smooth, sulphureous becoming brownish; apoth. chestnut, with an obscure, crenulate thalline margin. *Dufourea arctica, Rich. in Frankl. Narr. p.* 762 & Icon, *t.* 31.

Bear Lake, and elsewhere in Arctic America, *Rich.* (herb. Hook.!). I follow Fries in considering the Dufoureæ a section of the present genus. Hooker (App. to Parry's Sec. Voy. l. c.) refers Dufourea nodosa, R. Br. (Ross's Voyage), to a variety of the present species. I have not seen the description of Brown.

§ III. *Physcia*, Fr. Foliaceous-compressed, the under side channelled.

8. E. *prunastri*, Ach. Th. subfoliaceous, ochroleucous (and pallescent), laciniæ linear-attenuate, rugose-lacunose; on the under side somewhat channelled and white; apoth. subpedicellate, cyathiform, rufous. *Fr. Lichenogr. p.* 25.

Trees and shrubs, more rarely on stones and rails. Arctic America, *Rich.* Canada, fertile, *Herb. Hook.!* More common with us in degenerate states. New England. New York, *Torr.* Pennsylvania, *Muhl.*

9. E. *furfuracea*, Mann. Th. subfoliaceous, glaucous (oftener cinereous-furfuraceous), laciniæ linear, dichotomous; channelled and becoming black on the under side; apoth. pedicellate, disk rufescent. *Fr. Lichenogr. p.* 26. *Borrera, Ach.* — *β. Cladonia*, Tuckerm.; suffruticulose, naked, laciniæ patent, much branched, and often somewhat thyrsoid-entangled.

Trunks, common and fertile; more rarely on stones, &c.; New England. New York, *Halsey.* — *β*, firs and other trees, on the mountains of Northern New England, fertile.

III. RAMALINA, Ach.

Apothecia rounded, scutelliform, thick, pedicellate-subpeltate, scattered upon both sides of the thallus, disk open, placed upon the (green) gonimous stratum. Thallus originally erect, ramose-laciniate, similar throughout, and of the same color.

Two species occurring in the North of Europe are as yet wholly wanting with us: — *R. pollinaria*, Ach., with a softish, flaccid, corrugated thallus besprinkled with white powdery spots; and *R. scopulorum*, Ach., with a thick, rigid, polished, often terete thallus, attaining to a very large size. At the extreme South, we may possibly have some West Indian species, or others peculiar to this continent. The late Mr. Menzies kindly presented me with two, collected by him on the coast of the Mexican State of California, which may be noticed briefly in this place. It is probable the first, at least, has been already described, but I have not been able to find any account of it. *R. retiformis*, Menz. herb.; subcartilagineous, much elongated, the irregular flexuous branches dilated above and regularly reticulate-perforate; apoth. lateral. Monterey! — *R. Menziesii*, Tuckerm.; submembranaceous, thin, deeply lacunose or plane, canaliculate, smooth; apoth. lateral, sessile, with a thin, elevated margin. *R. scopulorum? Menz. herb. R. scopulorum, var. tenuissima, Hook. & Arn. in Beechey's Voy.*

p. 163? Monterey! Appears to me to differ from R. scopulorum in its softish, plane, often deeply lacunose, and thin thallus, as well as in the apothecia. — ROCCELLA, a genus nearly allied to the present and the last, and diffused throughout the warmer regions of the globe, has not as yet any North American representative. I saw, however, in a small collection of "Algæ from Carolina, Bermudas, and the Caribbees, by the Rev. Mr. Clerk," in the British Museum, a Roccella, which resembled R. phycopsis, Ach.; but it is uncertain at which of the above localities this Lichen was obtained.

1. R. *calicaris*, Fr. Thallus ramose-foliaceous, cartilagineous, rigescent, lacunose, glaucous; apothecia pedicellate, with elevated margins, disk plane, palish. *Fr. Lichenogr. p.* 30. — *α. fraxinea*, Fr.; laciniæ longer and broader, the fertile ones plane; apoth. lateral. *R. fraxinea, Ach.* — *β. fastigiata*, Fr.; laciniæ shorter, fastigiate, subcompressed, lacunose; apoth. somewhat terminal. *R. fastigiata, Ach.* — *γ. canaliculata*, Fr.; laciniæ sublinear, narrow-attenuate, fertile ones channelled; apoth. affixed to the reflexed apices. *Lichen calicaris, L. R. fastigiata, β., Ach.* — *δ. farinacea*, Schær.; laciniæ linear-attenuate, sublacunose (sorediiferous), rigid; apoth. scattered. *R. farinacea, Ach.*

Very common: *α*, *β*, and *γ*, on trees, rails, &c.; the last especially in mountain forests; *δ*, abundant in the New England mountains, and northward, on trees and rocks. New York, *Torrey*. Pennsylvania, *Muhl.*

2. R. *polymorpha*, Ach. Th. cæspitose, cartilagineous-rigid, longitudinally costate-rugose, glaucous (and pallescent), often sorediiferous and the soredia capituliform; apoth. subterminal, pedicellate, with elevated margins, disk concave, pale. *Fr. Lichenogr. p.* 32. — *β. tinctoria*, Ach.; laciniæ sublinear, diffuse, linear-lacunose, lacerate-incised and pulverulent at the apices. *Ach. Lichenogr. p.* 601.

Rocks and stones, fertile; New England, and westward, very common. New York, *Halsey*. Pennsylvania, *Muhl.* Arctic America, *Rich.*

IV. CETRARIA, Ach., Fr.

Apothecia scutellate-peltate, affixed obliquely to the apices of the thallus. Thallus cartilagineous-membranaceous, originally ascendant; smoothish on the under side; lobes either somewhat terete, or foliaceous and somewhat concave above.

All the European species, and indeed all that belong to the genus (as revised by Fries) in the last general work of Acharius (Synopsis), occur with us, with several others. It is difficult to define strictly the limits between the foliaceous species of Cetraria and some Parmeliæ of the subsection Imbricaria; and in his Flora Scanica, Fries has suggested the possibility of extending Cetraria to include most or all of the Imbricariæ. But the genus, as limited in the Lichenographia Europæa, seems a natural one, and well distinguished from Parmelia.

§ 1. *Cartilagineæ*, Fr. Thallus cartilagineous, suberect.

1. C. *tristis*, Fr. Thallus fruticulose, horny-cartilagineous, rigid, solid, distichally dichotomous, pitch-black, branches fastigiate, terete; apothecia terminal, plano-convex, disk fuscous-black. *Fr. Lichenogr. p.* 34. *Cornicularia, Ach.*

Alpine and arctic rocks. Arctic America, *Rich.*

2. C. *odontella*, Ach. Th. fruticulose, rigid, solid, subcompressed, palmate-ramose, dark-brownish-chestnut, branches plane, dentate (not ciliate-spinulose); apoth. terminal, plane, disk fuscous. *Fr. Lichenogr. p.* 35.

Stones and moist rocks in alpine districts. Newfoundland, *Despreaux* in herb. Deless.! *Bory* in herb. Kunth! fertile. Northward to Arctic America, *Herb. Hook.!* Melville Island, *R. Br.* (Parry's First Voy.).

3. C. *aculeata*, Fr. Th. fruticulose, rigid, subfistulous, lacunose-compressed, very much and irregularly branched, dark-brownish-chestnut, branches divaricate, black-spinulose; apoth. terminal, peltate, denticulate, disk of the same color. *Fr. Lichenogr. p.* 35. *Cornicularia, Ach.*

On the earth in alpine and subalpine districts. White Mountains, fertile. Northward to Arctic America, *R. Br.*, *Hook.!*

4. C. *Richardsonii*, Hook. Th. subfoliaceous, canaliculate, divaricate-bipinnatifid, naked or sparingly black-denticulate, dark-chestnut; apoth. marginal, subpedicellate, margin granulate or irregular, disk yellowish-brown. *Hook. in Frankl. Narr. p.* 761, & Icon, *t.* 31.

Barren grounds north of Great Slave Lake, *Rich.* (herb. Hook.! & herb. Grev.!). Prostrate.

5. C. *Islandica*, Ach. Th. subfoliaceous, sublinear, canaliculate, ciliate-spinulose, olivaceous-chestnut; apoth. obliquely scutellate, adnate to the upper side of the lobes, very entire, disk dark-chestnut.

Fr. Lichenogr. p. 36. — *β. platyna*, Fr.; laciniæ broader, flattish, waved. *Fr. l. c.* — *γ. crispa*, Ach.; laciniæ narrow, crisped, with connivent margins. *Fr. l. c.*

On the earth in alpine and subalpine districts, and at lower elevations northward, abundant and fertile; *γ* not found elsewhere. Also degenerate and sterile on hill-sides, and in sandy fields near the coast, throughout New England. New York, *Torrey*. Pennsylvania, *Muhl.*

6. C. *cucullata*, Ach. Th. subfoliaceous, sinuate-laciniate, ochroleucous, sanguineous-fuscous at the base, margins connivent and waved; apoth. adnate to the under side of the lobes, disk pale-flesh-colored. *Fr. Lichenogr. p.* 37.

On the earth in alpine and subalpine districts. White Mountains, fertile. Northward to Arctic America, *Rich.*

7. C. *nivalis*, Ach. Th. foliaceous, erectish, lacunose-reticulate, lacerate-laciniate, ochroleucous, yellowish at the base; laciniæ canaliculate-patulous, crisped; apoth. marginal, crenulate, yellowish-flesh-colored. *Fr. Lichenogr. p.* 38.

On the earth in alpine and subalpine districts. White Mountains, fertile. Northward to Arctic America, *R. Br.* (Scoresby).

§ II. *Membranaceæ*, Fr. Thallus coriaceous-membranaceous, the sterile fronds subdepressed.

8. C. *glauca*, Ach. Th. membranaceous, foliaceous, expanded, sinuate-lobed, ascendant, glaucous (and cinerascent); becoming black on the under side; apoth. terminal, peltate, dark-reddish-chestnut. *Fr. Lichenogr. p.* 38. — *α. fertilis*, Fr.; laciniæ elongated, channelled, becoming whitish on both sides, or spotted with white. *Fr. l. c.* — *β. sterilis*, Fr.; laciniæ shorter, wider, subdepressed, the under side fuscous-black. *Fr. l. c.*

Trunks of trees, stones, &c., in mountain forests, and elsewhere; New England. Northward to Newfoundland, *Pylaie.*

9. C. *sepincola*, Ach. Th. membranaceous, foliaceous, ascendant, laciniate, from green becoming olivaceous-fuscescent; paler beneath; laciniæ plane (the margins sometimes crisped, pulverulent), fertile ones short; apoth. adnate to the upper side of the lobes, dark-fuscous. *Fr. Lichenogr. p.* 39.

Trees and dead wood. Branches of dwarf firs, with C. pinastri, White Mountains, fertile. Arctic America, *Rich.* Hudson's Bay, *Herb. Banks!* Northwest Coast, *Menzies!*

10. C. *ciliaris*, Ach. Th. subcoriaceous, foliaceous, reticulate-lacunose, greenish glaucous becoming fuscescent; whitish-fuscescent beneath; laciniæ ascendant, crisped, ciliate or black-denticulate; apoth. elevated, blackish-fuscous, with a crenate margin. *Ach. Syn. p.* 227.

Trunks of trees, and old rails, common and fertile; ascending to subalpine districts, where it is often very small, and resembles the last; New England. New York, *Halsey*. Pennsylvania, *Muhl.!*

11. C. *lacunosa*, Ach. Th. cartilagineous-coriaceous, foliaceous, round-lobed, rugose-reticulate-cellulose, glaucescent; whitish on the under side, or spotted with white; laciniæ ascending, the margins crenate, crisped, black-denticulate; apoth. large, elevated, dark-reddish, entire. *Ach. Meth.* 295, *t.* 5, *f.* 3, *Syn. p.* 227. *Lichen cavernosus, Menz. herb.* — *β. Atlantica*, Tuckerm.; cartilagineous-membranaceous, lacunose-reticulate; apoth. at length perforate. *C. lacunosa, Hals. Lich. N. Y., l. c. & Auct. Amer. C. Tuckermanii, Oakes in Sill. Jour.*

Trunks of trees, and old rails. — *α*, Northwest coast, *Menzies!* — *β*, Lake Superior to New England, fertile. New York, *Halsey*. Pennsylvania, *Muhl.* The plant of Menzies differs from ours considerably, but more specimens of the Oregon Lichen are required, to settle the distinctness of the two.

12. C. *placorodia*, Tuckerm. Th. subcartilagineous, foliaceous, of narrow, at first smooth and discrete, at length convex, concrete, and plicate lobes, finally besprinkled with black grains or wholly isidiophorous, pale livid-glaucous; on the under side fuscescent, rugose, smooth, sparingly fibrillose; laciniæ crisped, crenate; apoth. marginal, peltate on the ascending lobules, from pale fuscous becoming dark chestnut, with an inflexed crenate margin, at length explanate. *Parmelia placorodia, Ach.! Syn. p.* 196.

Trunks (normal), Chelmsford, *Russell!* and common on rails, when (like C. ciliaris, C. lacunosa, and others) it assumes a Parmeliaceous aspect. From Parmelia it appears to me distinct, in its marginal, obliquely affixed apothecia, and its smooth, reticulate-rugose under-side. Acharius was acquainted only with the rail-Lichen.

13. C. *aurescens*, Tuckerm. Th. subcoriaceous, foliaceous, plane, sinuate-lobed, yellowish-green; beneath whitish with pale fuscescent fibres; margins of the lobes elevated, crisped, black-denticulate; apoth. large, elevated, chestnut, with a thin crenulate margin.

Trunks and branches of Coniferæ, New Hampshire. And old rails, Massachusetts.

14. C. *Oakesiana*, Tuckerm. Th. subcoriaceous, foliaceous, depressed, linear-laciniate, from green becoming yellow; fuscous on the under side, with scattered coarse fuscous fibres; laciniæ plane, with elevated, black-ciliate (or more commonly pulverulent) margins; apoth. marginal, elevated, rufous-fuscous, somewhat entire. *Tuckerm. Lich. N. E. in Bost. Jour. Nat. Hist.* 1841, *p.* 445.

Trees and rocks in mountain forests, New England; fertile.

15. C. *viridis*, Schwein. Th. membranaceous, foliaceous, round-lobed, lacunose-reticulate, glaucous-green; pale yellow on the under side; margins waved, black-denticulate; apoth. chestnut-brown, with an inflexed, lobate-dentate margin. *Schwein. in Hals. Lich. N. Y. l. c. p.* 16.

Cedars, Massachusetts. New York, *Halsey*. Certainly very near the next; and the Massachusetts Lichen here referred to it is perhaps nothing but a state of C. juniperina, *β*.

16. C. *juniperina*, Ach. Th. membranaceous, foliaceous, ascendant, sublacunose, lacerate-laciniate, bright yellow; on the under side subreticulate, of the same color; laciniæ concave, crisped, black-denticulate; apoth. adnate to the lobes in front, disk fuscous, margin crenulate. *Fr. Lichenogr. p.* 40. *C. juniperina, Ach. Syn. p.* 226, & *C. Tilesii, Ach.! Syn. p.* 228. — *β. virescens*, Tuckerm.; glaucous-green becoming pale yellowish, pale beneath.

On trees, and on the earth, Arctic America, *Rich.*, *Hook.!* — *β*, cedars and other trees, and rails, on the coast of Massachusetts, *Russell!* and southward to New York, *Torrey*, and Pennsylvania, *Muhl.* Our *β* can be compared only with the low-country Lichen of the North of Europe, from which it appears to differ as described. The alpine European forms, and our own arctic ones, recede variously from this type.

17. C. *pinastri*, Sommerf. Th. membranaceous, foliaceous, depressed, round-lobed, greenish-yellow; laciniæ plane, not denticulate (with crisped and powdery margins in the sterile plant); 'apoth. marginal, disk yellowish-brown, margin obtuse.' *Fr. Lichenogr. p.* 40. *C. juniperina, β. pinastri, Ach. Tuckerm. Lich. N. E. l. c.*

Subalpine shrubs and rocks; also trees in mountain woods and swamps, infertile; New England. Northward to Arctic America, *Rich.*

V. NEPHROMA, Ach.

Apothecia reniform, plane, not velate, adnate to the under side of the thallus, with an elevated thalline margin. Thallus membranaceous, softish, somewhat villous on the under side.

Nephroma is constituted a section of Peltigera in the Lichenographia of Fries, but in his Flora Scanica, 1835, and his Summa Fl. Scand. 1845, these genera are recognized as distinct; as they are also by Montagne. Feé (Crypt. Exot. Suppl. p. 8) remarks that they differ also in their thecæ.

1. N. *arcticum*, Fr. Thallus coriaceous-membranaceous, smooth, ochroleucous; on the under side subvillous, becoming black; fertile lobules somewhat elongated, erectish; apothecia dark orange-red. *Peltigera arctica, Fr. Lichenogr. p. 42. N. polaris, Ach. Tuckerm. Lich. N. E. l. c.*

Rocks among mosses, and on dwarf firs, in alpine and subalpine districts. White Mountains, fertile. Abundant in Newfoundland, and forming patches of two or three feet in extent, *Pylaie!* in herb. Kunth. Northward to Greenland, *Brasen* (Fl. Dan.), and elsewhere in Arctic America, *Rich.*

2. N. *resupinatum*, Ach. Th. cartilagineous-membranaceous, smooth, from glaucous becoming fuscescent; pale and downy on the under side, which is sparingly besprinkled with whitish soredia; apoth. rufous-fuscous. *Ach. Syn. p.* 241.

Trunks, often of mountain ash, in mountain forests, luxuriant and fertile; New England. New York, *Halsey*. Arctic America, *Rich.* Darker on rocks, where it is frequently quite small.

3. N. *parile*, Ach. Th. membranaceous, suborbiculate, softish, livid-fuscous; on the under side naked, rugulose, dark; (the laciniæ often sorediiferous, and pulverulent at the margins), fertile lobules short; apoth. dark-fuscous. *Ach. Syn. p.* 242.

Rocks. White Mountains, not uncommon. And on the coast, *Mr. Oakes*. Fertile.

4. N. *Helveticum*, Ach. Th. cartilagineous-membranaceous, somewhat rigid, glaucous-fuscescent; on the under side tomentose, becoming black; margins of the lobes and of the apothecia fimbriate-toothed; fertile lobules somewhat elongated; apoth. blackish. *Ach. Syn. p.* 242.

Trees and rocks, fertile, New England. A small rock-form occurs (N. aspera, Tuckerm. Lich. N. E. l. c.), analogous to a similar one of N. resupinatum.

VI. PELTIGERA, Hoffm.

Apothecia orbiculate, peltæform, plane, adnate to the upper side of elongated lobes of the thallus, or more rarely marginal; with a thin margin of the thallus. Thallus coriaceous-membranaceous, venose on the under side.

1. P. *malacea*, Ach. Thallus spongy, soft, smooth, round-lobed, fuscous-cinerascent, clothed on the under side with a dense blackish tomentum becoming white towards the margins; apothecia ascendant, rounded, margin crenulate. *Fr. Lichenogr. p.* 44.

Mountainous districts; on the earth and on shrub firs near the limit of trees, and on rocks at lower elevations, White Mountains.

2. P. *aphthosa*, Hoffm. Th. coriaceous, smooth, besprinkled with warts, bright green (and glaucescent); reticulated with blackish veins, and fibrillose on the under side; apoth. large, ascendant, round, with a somewhat lacerate margin. *Fr. Lichenogr. p.* 44.

Rocks among mosses, and on the earth. Common in mountain forests; New England. New York, *Torrey.* Pennsylvania, *Muhl.* Northward to Newfoundland, *Pylaie;* and Arctic America, *Rich.*, *R. Br.*

3. P. *canina*, Hoffm. Th. membranaceous, flaccid, scrobiculate, subtomentose, fuscous-green (and cinerascent, and hoary); the under side whitish and reticulated with pale fuscous veins; apoth. ascendant, rounded, at length semi-revolute, vertical. *Fr. Lichenogr. p.* 45.

On the earth, rocks, and mossy trunks, common in New England. New York, *Torrey.* Pennsylvania, *Muhl.* Northward to Greenland, *Gieseke.*

4. P. *rufescens*, Hoffm. Th. coriaceous, soft, subtomentose, cinereous-virescent (and cinereous, and rufescent); fuscous-fibrillose on the under side, and reticulated with black-fuscous veins; lobes rather narrow, with elevated and crisped margins; apoth. at length vertical, oblong, revolute. *Fr. Lichenogr. p.* 46. *Peltidea spuria, Ach. Tuckerm. Lich. N. E. l. c.*

On the earth, rocks, and trunks among mosses; New England: Thallus smaller and thicker than in the last.

5. P. *polydactyla*, Hoffm. Th. papyraceous, very smooth, shining, plumbeous-virescent (and gray), on the under side almost naked, reticulated with spongy fuscous veins; (fertile lobules often very numerous;) apoth. ascending, finally revolute. *Fr. Lichenogr. p.* 46. — *β. scutata*, Fr.; margins often crisped (or powdery); apoth. at first transversely oblong, at length erect and revolute. *Fr. l. c. Peltidea scutata, Ach.*

Rocks and trunks among mosses, abundant in mountain forests; New England. New York, *Halsey*. Pennsylvania, *Muhl.* The variety *β* may be taken for the next species, which has a different thallus. P. reticulata, Hook. ms. (herb. Borr.!), from the Northwest Coast, is near this, but apparently a distinct species. I have not seen the description.

6. P. *horizontalis*, Hoffm. Th. coriaceous, lacunulose, smooth, fuscous-virescent; the under side reticulated with black veins; apoth. transversely oblong, plane, horizontal. *Fr. Lichenogr. p.* 47.

Rocks and trunks, among mosses, less common than the last; New England. New York, *Torrey*. Pennsylvania, *Muhl.* Margins of the thallus sometimes crisped, and the under side scarcely venose (var. lophyra, Ach.).

7. P. *venosa*, Hoffm. Th. coriaceous (small), fan-shaped, simple, green (and cinereous); white on the under side, and variegated with fuscous-black, divaricately branched veins; apoth. adnate to the thallus, round, horizontal. *Fr. Lichenogr. p.* 48.

On the earth, in woods. Pennsylvania, *Muhl.* New York, *Torrey!* Northwest Coast, *Menzies!*

VII. SOLORINA, Ach.

Apothecia suborbiculate, depressed, adnate to the disk of the thallus, covered originally with a thin membrane, which forms at length an evanescent margin, 'subgelatinous within.' Thallus coriaceous-membranaceous, foliaceous, venose or lanuginous beneath.

Eschweiler (Syst. p. 21, & Lich. Brasil. in Mart. Fl. Bras. 1833, p. 60) considers this genus very distinct from Peltigera in the peculiar evolution of its apothecia. The apothecia of some species of Peltigera are indeed velate, and this is the case with nearly all, according to Fries; but these groups differ also in their thecæ, as shown by Eschweiler and by Feé, and in a somewhat different habit. Montagne (Bot. Zeitung,

1, p. 476), Flotow (Ibid. p. 613), Feé (Crypt. Exot. l. c.), and J. D. Hooker (Lich. Antarct. in Hook. Jour. Bot.) have enlarged the present genus by the addition of some interesting tropical and other species.

1. S. *crocea*, Ach. Thallus coriaceous, lobed, obscurely green becoming cinnamon-colored; on the under side saffron-colored, with rather obscure, branched, anastomosing veins; apothecia applanate, immarginate, dark-chestnut. *Ach. Syn. p.* 8. *Peltigera, Fr. Lichenogr. p.* 48.

On the earth, Arctic America. Greenland, *Dill.* North of Point Lake, *Rich.* (Herb. Hook. !).

2. S. *saccata*, Ach. Th. membranaceous, subimbricate, from green becoming greenish-cinerascent; on the under side whitish and fibrillose; apoth. applanate, finally saccate-depressed, blackish-fuscous. *Ach. Syn. p.* 8. *Peltigera, Fr. Lichenogr. p.* 49.

Rocks (limestone), New York, *B. D. Greene, Esq.* Newfoundland, *Pylaie.* Northward to Bear Lake, *Herb. Hook. !* Solorina orbiculata, Menz. herb. ! from the Pacific coast, appeared to me a distinct, but I believe it is an undescribed species.

VIII. STICTA, Ach.

Apothecia scutelliform, adnate to the margin or disk of the thallus, somewhat oblique, the margin free beneath. Disk at first closed, nucleiform; becoming at length elevated and explanate. Thallus expanded from a centre, foliaceous, coriaceous-cartilagineous, lobate, villous on the under side, and having on this side small, regular urceolate cavities (*cyphellæ*), or where these are wanting soredia, or discolored spots.

A mostly tropical genus, with many West Indian and South American species, some of which are represented in the extreme southern parts of the United States.

1. S. *aurata*, Ach. Thallus subcoriaceous, reddish-brick-colored; on the under side lanuginous, reddish-yellow at the circumference, and besprinkled with small, irregular, often sorediiform, yellow cyphellæ; laciniæ rounded, sinuate-cut, the margins undulate, crisped, and yellow-pulverulent; 'apothecia marginal, disk plane, fuscous-red, margin inflexed.' *Delis. Stict. p.* 49.

Among mosses on rocks and trees. (Southern States ! and Texas ! infertile.) Ohio? The Southern Lichen probably occurs within our limits.

2. S. *crocata*, Ach. Th. submembranaceous, scrobiculate, greenish-glaucous-fuscescent; on the under side lanuginous, liver-colored at the circumference, with minute, pale-lemon-colored cyphellæ; laciniæ short, rounded, crenulate, with yellowish-pulverulent margins; 'apoth. scattered, fuscous-black.' *Delis. Stict. p.* 56.

Rocks among mosses, New England, infertile; less common in the Northern mountains. S. *Feei*, Delis. l. c. p. 44, from North America, is perhaps a Southern species.

3. S. *sylvatica*, Ach. Th. coriaceous-membranaceous, laciniate-lobed, lacunulose, greenish-fuscous; tomentose, and subfuscous-cinerascent beneath, with urceolate, whitish cyphellæ; lobes somewhat truncate, rounded, crenulate; 'apoth. marginal, peltate, rufous-fuscous.' *Fr. Lichenogr. p.* 51.

Rocks, among mosses. Pennsylvania, *Muhl.*, New York, *Halsey.* S. *fuliginosa*, Ach., differs principally in its round-lobed, rugose fronds, frequently isidioid-efflorescent, and its (normal) sessile, orbiculate apothecia. The described apothecia of S. sylvatica depend upon the figures of Dillenius, Wulfen, &c. The species is now unknown in a fertile state.

4. S. *quercizans*, Ach. Th. cartilagineous, laciniate, plane, pale-rufous-fuscous; somewhat tomentose, and subfuscous-nigrescent beneath, with urceolate (membranaceous), whitish cyphellæ; lobes subimbricate, oblong, rounded, crenulate; 'apoth. scattered, disk somewhat concavo-plane, with a thin entire margin.' *Delis. Stict. p.* 84. *Lobaria*, *Michx.*

Pennsylvania, *Herb. Montagne!* Mossy rocks, New York, *Russell!* The specimens from Mr. Russell seem to me to differ from S. sylvatica in the characters indicated by Delise, and to agree with his S. quercizans, as they also do with my brief notes on the specimen (from Carolina) in herb. Michaux. S. *Beauvoisii*, Delis. l. c. p. 83, constituted on a North American Lichen, seems hardly distinct from the present.

5. S. *scrobiculata*, Ach. Th. coriaceous, suborbiculate, lax, scrobiculate, leaden-gray (and glaucescent); lanuginous on the under side, with naked, white spots; laciniæ rounded, somewhat entire (commonly sorediiferous); 'apoth. scattered, from rufous becoming fuscous.' *Fr. Lichenogr. p.* 53.

Trunks, and rocks among mosses, New England; infertile. Northward to Newfoundland, *Pylaie.* S. *limbata*, Ach., a species resembling this, but with urceolate, true cyphellæ, very possibly occurs with us.

6. S. *anthraspis*, Ach. Th. cartilagineous-membranaceous, lacu-

nose-reticulate, broadly round-lobed, cinereous-virescent; rugulose and somewhat villous beneath, with small, white, sorediiform cyphellæ; lobes somewhat crenate; apoth. scattered, disk at length convex, black, and excluding the entire thalline margin. *Ach. Syn. p.* 233.

On the earth, among mosses; Northwest Coast, *Menzies!* New York, *Halsey*. The upper surface resembling that of S. pulmonaria.

7. S. *pulmonaria*, Ach. Th. coriaceous, lax, lacunose-reticulate, dark green (and olivaceous); tomentose on the under side, with naked, white spots; laciniæ elongated, discrete, sinuate-lobed, retuse-truncate; apoth. submarginal, rufous. *Fr. Lichenogr. p.* 53. *Lichen pulmonarius, L.*

Trunks in mountain forests, fertile. Also on rocks, where various sterile forms are found. Among these is S. linita, Ach., quoted by Delise as from the United States, which has occurred at the White Mountains, with all the features of the Swiss Lichen. New England. New York, *Torrey*. Pennsylvania, *Muhl.* Newfoundland, *Pylaie.*

8. S. *glomerulifera*, Delis. Th. coriaceous-cartilagineous, thick, orbicular, appressed, smooth, from pale green becoming glaucescent; villous on the under side, with scattered, excavated cyphellæ (which are often wanting); laciniæ elongated, sinuate-lobed; apoth. scattered, dark-reddish-chestnut, with a rugose, persistent margin. *Delis. Stict. p.* 129. *Tuckerm. Further Enum. l. c. Parmelia, Ach.*

Trunks of trees, and rocks, fertile; New England. Pennsylvania, *Muhl.* in herb. Willd.! Northward to Newfoundland, *Pylaie.* The green glomerules of the European Lichen always wanting in ours. Young plants of this species may be taken for the next.

9. S. *herbacea*, Ach. Th. membranaceous, appressed, smooth, obscurely green (and glaucescent); on the under side paler, lanuginous, the membranaceous, hoary cyphellæ rare; laciniæ sinuate-repand, rounded at the apices; apoth. scattered, rufous, margin crenulate. *Ach. Syn. p.* 341. *Parmelia, Ach. Syn. p.* 198.

Trunks and rocks. Pennsylvania, *Muhl.* New York, *Torrey*, *Halsey.* Arctic America, *Rich.*

IX. PARMELIA, Ach., Fr.

Apothecia scutelliform, orbicular, adnate horizontally to the disk of the thallus, with an equal thalline margin. Disk at first connivent-

closed, somewhat waxy. Thallus expanded horizontally from a centre, two-sided, of various form, upon a hypothallus. *Fr. Lichenogr. p.* 56.

SYNOPSIS OF THE SECTIONS.

Sect. I. The fibrillose hypothallus adnate to the foliaceous thallus, which is discrete from the matrix.

Subsect. I. IMBRICARIA, Fr. — Apothecia elevated, subpedicellate, regular; disk very thin, naked, placed upon the gonimous layer. Thallus imbricate-foliaceous; often black-dotted from abortion of the apothecia. — Sp. 1–24.

Subsect. II. PHYSCIA, Fr. — Apothecia at first closed, at length dehiscent. Disk thickish, waxy, placed upon the medullary layer. Thallus normally foliaceous; ascendant or stellate; fibrillose on the under side.

* Thallus normally ascendant, or loosely decumbent; apoth. somewhat obliquely marginate. — Sp. 25.

** Thallus normally stellate-appressed; apoth. plane. — Sp. 26–33.

Sect. II. Thallus subfoliaceous, at length compacted into a conglomerate, subgranulose crust; arising from a fibrillose (rarely obsolete) hypothallus, which is adnate to the matrix.

Subsect. III. PYXINE, Tuckerm. — Apothecia erumpent, at first closed, palish; becoming patellæform, and, with the altered thalline margin, black; finally cephaloid, excluding the margin. Thallus subfoliaceous, imbricate-laciniate, at length crustaceous-concrete at the centre, on a black, fibrillose hypothallus. — Sp. 34.

Subsect. IV. AMPHILOMA, Fr. — Apothecia erumpent, somewhat coronate with an accessory thalline margin. Disk waxy, thickish, naked. Thallus foliaceous, somewhat monophyllous, rounded, at length crustaceous-compact at the centre, placed on a spongy-pannose hypothallus. — Sp. 35–38.

Subsect. V. PSOROMA, Fr. — Apothecia for the most part two-formed, adnate or immersed; arising in the one case from the thallus, with a crenate-thalline margin; and in the other from the hypothallus, with an entire proper margin. Disk waxy. Thallus of discrete, foliaceous squamules, arising from a common hypothallus; often at the centre, or wholly, concrete in a subgranulose crust. — Sp. 39–41.

Sect. III. Thallus crustaceous, lobed at the circumference, or wholly squamulose-effigurate. Hypothallus smooth, adnate to the matrix, often confused with the thallus.

Subsect. VI. Placodium, Fr. — Apothecia plano-scutelliform, elevated, disk without proper margin, naked. Thallus as above. (Thalline margin often colored like the disk.) — Sp. 42 – 47.

Subsect. VII. Psora, Fr. — Apothecia innate, at first somewhat urceolate, afterwards scutelliform. Disk with a proper margin (visible at least in the younger apothecia), normally at first cæsious-pruinose. Thallus as above. — Sp. 48 – 50.

Sect. IV. Thallus crustaceous, uniform. Circumference similar, or the hypothallus sometimes fibrillose-radiant.

Subsect. VIII. Patellaria, Fr. — Apothecia regular, scutelliform, sessile, the thalline margin persistent. Lamina of the disk somewhat plane, without proper margin. Thallus crustaceous, adnate to an indeterminate, mostly black hypothallus. Disk not cæsious-pruinose. — Sp. 51 – 66.

Subsect. IX. Urceolaria, Fr. — Apothecia innate in the crust, or immersed in protuberant warts. Lamina urceolate, or protuberant, verrucæform, blackish, normally cæsious-pruinose, marginate. Thallus crustaceous; the whitish hypothallus confused with the thallus, or often fibrillose and radiant. — Sp. 67 – 70.

Sect. I. The fibrillose hypothallus adnate to the foliaceous thallus.

Subsect. I. Imbricaria, Fr.

Series 1. *Glaucescentes*, Fr.

1. P. *crinita*, Ach. Thallus submembranaceous, suborbicular, glaucous-fuscescent (the whole thallus, as well as the apothecia, beset with isidioid granules and branchlets); black and somewhat smooth on the under side, and here and there black-fibrillose; lobes plane, with somewhat ascendant, erose-crenate, ciliate margins; apothecia (imperforate) marginal, subpedicellate, cyathiform, with a thin, inflexed, crenulate margin, at length explanate, large. *Ach.! Syn. p.* 196. *P. perforata, β. Fr.*

Trunks, &c., fertile; New England. New York, *Torrey*. Pennsylvania, *Muhl.* There appear to be indications of other differences beside the isidioid efflorescence to distinguish this from P. perforata. The latter is perfectly normal with us.

2. P. *perforata*, Ach. Th. membranaceous, smooth, greenish-glaucescent; on the under side black, with dark fibres; lobes rounded, ascendant, subcrenate, ciliate; apoth. large, rufous, elevated, infundibuliform; disk perforate, at length explanate, margin very entire. *Fr. Lichenogr. p.* 58.

Trees, particularly on the coast, luxuriant and fertile. Also on stones, &c., in sterile states. Pennsylvania and Virginia (from Bartram and Mitchell), *Dill.*, the original stations of the Lichen. New England. New York, *Torrey*. Northwest Coast, *Menzies* (Herb. Smith!).

3. P. *perlata*, Ach. Th. submembranaceous, suborbicular, greenish-glaucous; on the under side blackish-fuscous, scarcely fibrillose; lobes rounded, plane, not ciliate; apoth. elevated, dark red, cyathiform, at length explanate, margin thin, entire. *Fr. Lichenogr. p.* 59. — *β. olivetorum*, Ach.; margins of the lobes elevated, crisped, white-pulverulent. *Ach. Syn. p.* 198.

Trunks and rocks in mountainous districts, fertile; and common also in sterile forms; New England. New York, *Halsey*.

4. P. *scortea*, Ach. Th. subcoriaceous, orbicular, smooth, glaucous-white; on the under side black, hispid-fibrillose; lobes longish, sinuate-crenate, incised; apoth. rufous-fuscous, margin somewhat entire. *Ach. Syn. p.* 197.

Stones and trunks, fertile; New England. New York, *Halsey*. Pennsylvania, *Muhl.* Less common than the next, with which Fries unites it.

5. P. *tiliacea*, Ach. Th. membranaceous, orbicular, smoothish, glaucous-cinerascent; on the under side blackish-fuscous, with black fibres; lobes sinuate-laciniate, the external ones rounded, crenate; apoth. subfuscous, margin very entire. *Ach. Syn. p.* 199.

Trunks, fertile, very common; New England. New York, *Halsey*. Pennsylvania, *Muhl.* Nova Scotia, *Menzies!*

6. P. *Borreri*, Turn. Th. cartilagineous-membranaceous, orbicular, smoothish, glaucous-cinerascent (with round, marginate soredia); on the under side fuscescent, fuscous-fibrillose; laciniæ rounded at the apices, naked; apoth. chestnut, margin inflexed, entire. *Fr. Lichenogr. p.* 60. — *β. rudecta*, Tuckerm.; soredia immarginate; the whole thallus beset with isidioid granules and branchlets. *P. rudecta*, *Ach.! Syn. p.* 197.

Trunks, &c., fertile; New York, *Halsey.* — β, New England. Pennsylvania, *Muhl.* The anamorphous development called by Sommerfelt Lecidea Parmeliarum, and referred by Acharius to Endocarpon, occurs not unfrequently in this species, as well as in the next.

7. P. *saxatilis*, Ach. Th. subcartilagineous, reticulate-lacunose, glaucous-cinerascent; black and fibrillose beneath; laciniæ sinuate-lobed, plane, subretuse; apoth. dark-chestnut, margin at length crenate. *Fr. Lichenogr. p.* 61. — α; laciniæ irregularly imbricate, narrower. *Ach. Lichenogr. p.* 469. — β. *rosæformis*, Ach.; th. orbicular, lobes wider, besprinkled commonly with elongated, marginate soredia; apoth. smaller, less explanate. *Ach. l. c. p.* 471. — γ. *omphalodes*, Fr.; th. smoothish, shining, dark purplish-fuscous, laciniæ subtruncate. *Fr. Lichenogr. p.* 62. *Parmelia omphalodes, Ach. Syn. p.* 203.

Rocks and stones, and, somewhat less commonly, on trees and rails, fertile; New England. New York, *Torrey.* Pennsylvania, *Muhl.* Northward to Arctic America, *Rich.* — γ. Arctic America.

8. P. *aleurites*, Ach. Th. membranaceous, orbicular, contiguous, rugose-plicate, glaucescent (at length furfuraceous); on the under side pale, with fuscous fibres; lobes discrete at the circumference, plane, rounded, cut-crenate; apoth. dark-fuscous, margin at length crenulate. *Fr. Lichenogr. p.* 62.

Dead wood, and firs, in mountainous districts, fertile; and on rocks, sterile. The sterile plant is also common on rails, &c., on the coast. New England. New York, *Halsey.* Fries refers to this species the P. *obsessa*, Muhl. Catal., and Ach. Syn. p. 213.

9. P. *lævigata*, Ach. Th. membranaceous, suborbicular, smooth, glaucescent; black, and fibrillose on the under side; laciniæ multifid, linear, plane, cut, divaricate (often sorediiferous); apoth. chestnut, margin very entire. *Ach. Syn. p.* 212.

Trunks (very common on beech in mountainous districts), fertile.

10. P. *sinuosa*, Ach. Th. membranaceous, suborbicular, smooth, glaucescent; black, and fibrillose on the under side; laciniæ linear, wider at the circumference, sinuate-pinnatifid, the sinuses wide, circular; apoth. somewhat plane, fuscous, margin thin, very entire. *Ach. Syn. p.* 207.

Trunks and rocks. Nova Scotia, *Ach.* Fries and Meyer refer this and the last to a single species, but Borrer regards them distinct.

11. P. *terebrata*, Mart. Th. somewhat inflated, suborbicular, greenish-glaucescent; plicate-rugose and black on the under side; laciniæ radiant, approximate, plane-appressed, sublinear (often sorediiferous), with small, regular, rounded perforations; apoth. scattered, plane, red, margin very entire. *Mart. Fl. Crypt. Erlang. P. diatrypa, Ach. Syn. p.* 219. *Tuckerm. Lich. N. E. l. c.*

Trunks in mountain forests, frequent, and rocks, fertile; New England.

12. P. *physodes*, Ach. Th. somewhat inflated, suborbicular, glaucous-white; black-fuscous and naked on the under side; laciniæ loosely imbricate, linear, sinuate-multifid, somewhat convex; apoth. elevated, reddish-fuscous, with an inflexed, entire margin, at length explanate. *Ach. Syn. p.* 218. — *β. enteromorpha*, Tuckerm.; laciniæ effuse, lax, somewhat elongated, ventricose-inflated; apoth. subpedicellate, ventricose-cyathiform, at length explanate, very entire. *P. enteromorpha, Ach.! Syn. p.* 219. *P. platycarpa, Tuckerm. Lich. N. E. l. c.*

Trunks, dead wood, and rocks, fertile; New England. New York, *Torrey*. Pennsylvania, *Muhl.* North to Arctic America, *Rich.* — *β*, firs and other trees in high mountain forests. Northwest Coast, *Menzies! Douglas* in herb. Hook.! Mountains of New England, fertile, and evidently passing into *α*.

13. P. *colpodes*, Ach. Th. somewhat inflated, suborbicular, greenish-glaucescent; black and spongy on the under side; laciniæ somewhat plane, at the circumference ramose-multifid, with irregularly dentate margins; apoth. elevated, chestnut, margin inflexed, entire. *Swartz Lich. Amer. p.* 4, & *t.* 3. *Ach.! Syn. p.* 219.

Trunks. Near Boston, *Swartz* (the original station of the Lichen). Throughout New England, common and fertile. New York, *Halsey*. Pennsylvania, *Muhl.*

Series 2. *Olivaceo-fuscæ*, Fr.

14. P. *olivacea*, Ach. Th. membranaceous, orbicular, smooth, rugulose (elevated-punctate, or granulate-farinose), olivaceous-fuscous; paler and subfibrillose on the under side; lobes radiant, appressed, plane, rounded, crenate; apoth. dark-olive, with an inflexed, at length crenate margin. *Fr. Lichenogr. p.* 66.

Trees in mountainous districts, fertile; also degenerant on dead wood and stones; New England. New York, *Torrey*. Pennsylvania, *Muhl.!* Northward to Arctic America, *Rich.*

15. P. *Fahlunensis*, Ach. Th. subcartilagineous, smoothish, from dark-olive becoming blackish; on the under side paler, subfibrillose; laciniæ digitate-multifid, somewhat plane, subcanaliculate; apoth. dark-fuscous, crenulate. *Fr. Lichenogr. p.* 66. — *β. sciastra*, Fr.; smaller, orbicular; apoth. subentire. *Fr. Lichenogr. p.* 67. *Parmelia*, Ach.

Alpine and subalpine rocks, and occurring also at lower elevations in mountainous districts. White Mountains; Chin of Mansfield, and other of the Green Mountains; fertile. Northward to Newfoundland, *Pylaie*, and Arctic America, *Rich.* — *β*, Greenland, *Dill.*

16. P. *stygia*, Ach. Th. subcartilagineous, shining, from olivaceous-fuscous becoming black; very black on the under side and obsoletely fibrillose; laciniæ palmate-multifid, sublinear, convex, recurved at the apices; apoth. fuscous-black, crenate. *Fr. Lichenogr. p.* 67. — *β. lanata*, Mey.; laciniæ setaceous, filiform, terete, intricate, fuscous-nigrescent; apoth. subgranulate-marginate. *Mey. Entwick. der Flecht. p.* 231. *Fr. l. c. p.* 68. *Cornicularia lanata*, *Ach. Syn. p.* 302.

Alpine and subalpine rocks. White Mountains and the higher Green Mountains. Northward to Newfoundland, *Pylaie*, and Arctic America, *R. Br.* — *β*, White Mountains, infertile. Northward to Arctic America, *Hook.* Melville Island, *R. Br.*

Series 3. *Ochroleucæ*, Fr.

17. P. *caperata*, Ach. Th. submembranaceous, orbicular, rugose (or granulose-pulverulent), ochroleucous; on the under side blackish and sparingly fibrillose; lobes sinuate-laciniate, rounded, somewhat entire at the apices; apoth. fuscous-red, margin tumid-incurved, rugose-crenate. *Fr. Lichenogr. p.* 69.

Trunks and stones, not commonly fertile; New England. New York, *Torrey.* Pennsylvania, *Muhl.* Westward to Illinois, *Russell!* North to Arctic America, *Rich.*

18. P. *conspersa*, Ach. Th. submembranaceous, smoothish, polished (oftener black-punctate), greenish-straw-colored; fuscous and black-fibrillose beneath; laciniæ variously flexuous, somewhat plane at the circumference, sinuate; apoth. dark-chestnut, margin subentire. *Fr. Lichenogr. p.* 69. — *β. stenophylla*, Ach.; laciniæ elongated, linear, pinnatifid, imbricate-complicate. *Ach. Syn. p.* 209.

Rocks and stones, commonly remarkable for its very numerous apothecia; New England. New York, *Torrey.* Pennsylvania, *Muhl.* North to Arctic America, *Rich.* Degenerate on rails, &c.

19. P. *incurva*, Fr. Th. cartilagineous-membranaceous, stellate-imbricate, globuliferous, greenish-straw-colored (and ochroleucous); black and fibrillose on the under side; laciniæ very narrow, multifid, subterete, recurved at the apices; apoth. rufous-fuscous, subentire. *Fr. Lichenogr. p.* 70. *P. recurva*, Ach.

Rocks in mountainous districts (subalpine, and descending). White Mountains; fertile.

20. P. *ambigua*, Ach. Th. membranaceous, orbicular, stellate-imbricate, farinose-sorediiferous, greenish-straw-colored (and ochroleucous); black and fibrillose on the under side; laciniæ plane, linear, appressed, multifid; apoth. adnate, rufous-fuscous, very entire. *Fr. Lichenogr. p.* 71.

Trunks and dead wood in mountainous districts, fertile; and on rocks, infertile; White Mountains. Northward to Arctic America, *Rich.*

21. P. *centrifuga*, Ach. Th. submembranaceous, suborbicular, greenish-straw-colored (and ochroleucous); white and fibrillose on the under side (the crust-like centre often falling away, and leaving a concentrically disposed circumference); laciniæ linear, concrete, convex, rugose; apoth. rufous-fuscous, margin subentire. *Fr.! Lichenogr. p.* 71.

Rocks (subalpine and descending) in mountainous districts, fertile; New England. New York, *Torrey.* Pennsylvania, *Muhl.* Northward to Newfoundland, *Herb. Banks! Pylaie.* An ochroleucous, black-punctate, not concentrically disposed state is P. Halseyana, Tuckerm. Lich. N. E. l. c. It occurs in the Notch of the White Mountains.

Series 4. *Citrinæ*, Fr.

22. P. *parietina*, Fr. Th. foliaceous or squamulose, imbricate, membranaceous, sublobate, yellow; paler and obsoletely fibrillose on the under side; apothecia with elevated margins, very entire. *Fr. Lichenogr. p.* 72. — *α.* (*foliacea*), Fr.; th. foliaceous, from greenish becoming bright yellow; lobes explanate, appressed. *P. parietina, Ach.* — *β. aureola*, Fr.; th. foliaceous, somewhat zoned and subcentrifugal, dark-golden-yellow; lobes concrete, plicate-ramose. *P. aureola, Ach.* — *γ. rutilans*, Fr.; th. foliaceous-subcrustaceous, imbricate-complicate, irregularly laciniate. *P. rutilans, Ach.* — *δ. laciniosa*, Duf.; th. naked, lacerate-dissected, squamulose; laciniæ ascending, naked. — *ε. polycarpa*, Fr.; th. smaller, conglomerate; the lobes complicated, and covered with the

very numerous apothecia. *Lecanora caudelaris*, β. *Ach.* — ζ. *lobulata*, Fr.; th. obliterated, or consisting only of very short, scattered, appressed lobules, with small apothecia. — η. *substellata*, Ach.; th. foliaceous, substellate, lacerate-laciniate, laciniæ expanded, pulverulent. — ϑ. *concolor*, Fr.; th. pulverulent, squamulose, lacerate-laciniate, scales crowded, ascendant. *Lecan. caudelaris*, α. *Ach.* — ι. *citrinella*, Fr.; the whole thallus dissolved into a yellowish-green dust.

Very common: α, on trunks, rocks, &c.; β, on rocks and stones (especially maritime), exposed to the sun; γ and δ, on trunks, exposed to the sun; ε and ζ, on the smaller branches and twigs of trees; η and ϑ, on smooth bark, the last also common on dead wood; ι, on bark and dead wood in moist places; New England. New York (γ and ϑ), *Halsey*. Pennsylvania (ϑ), *Muhl.* Ohio (α), *Mr. Lea!* Illinois (α), *Russell!* Northward to Nova Scotia (γ), *Menzies!* Newfoundland (α), *Pylaie*, and Arctic America (ε and ϑ), *Rich.!* I have adopted Fries's view of the European species nearly entire. He remarks that he has distinguished and enumerated these forms, not so much on account of their importance as distinct states, as to furnish an example, that can almost everywhere be authenticated, of the extremely Protean character of the thallus of Lichens.

23. P. *diversicolor*, Ach. Th. suborbicular, yellowish-orange-red (becoming whitish with age), of rather narrow, somewhat lacerate-ramose, rugose, at length concrete laciniæ; white-cinerascent, with fibres of the same color beneath; apoth. numerous, concave, blackish-sanguineous, margin thick, at length white. *Ach. Syn. p.* 210.

Arctic America, and southward, *Ach.*

24. P. *chrysophthalma*, Ach. Th. subfoliaceous, cartilagineous-membranaceous, lacerate-ramose, from dark reddish-yellow becoming whitish; on the under side whitish, and fibrillose at the margins; laciniæ depressed-subascendant, plano-convex, pinnatifid; apoth. dark-orange, fibrillose-ciliate or naked. *Fr. Lichenogr. p.* 75. *Borrera*, *Ach.* — β. *exilis*, Fr.; laciniæ very narrow; margins of the apothecia naked. *Fr. l. c. Borrera*, *Ach.*

Trunks and branches of trees near the coast, and luxuriant in places exposed to the sea-spray; New England. New York, *Torrey* (at Newburgh, *Russell!*). Pennsylvania, *Muhl.* Illinois, *Russell!*

Subsect. II. PHYSCIA, Fr.

25. P. *ciliaris*, Ach. Thallus cartilagineous, from green becoming glaucous; laciniæ linear, ramose, subascendant, channelled beneath, ciliate with simple fibres; apothecia subterminal, pedicellate, margin erect, at length lacerate-dentate, fimbriate, or obliterated in foliaceous branches; disk plane, black, subpruinose. *Fr. Lichenogr. p.* 77. *Borrera, Ach.* — *β. galactophylla*, Tuckerm.; more delicate; the laciniæ very white and powdery beneath; margins of the apothecia at length obliterated in foliaceous expansions; disk white-pruinose. *P. galactophylla, Willd. herb. !* — *γ. angustata*, Tuckerm.; laciniæ extremely narrow, of nearly the same color beneath, subterete at the apices. *Borrera angustata, Bory ms.*

Trees, New England (*β*), rare. New York, *Torrey*. Pennsylvania (*β*), *Muhl. !* and southward, where *β* is common. North to Arctic America, *Rich.* — *γ*, Newfoundland, *Bory* in herb. Berol.! Rocky Mountains, *Herb. Hook. !* P. *leucomela*, Ach., a species near this, but with narrow, ascendant laciniæ, and tomentose marginal fibres, occurs in the Carolinas, *Michx. !* and California, *Menzies !* and P. *erinacea*, Fr., with lacerate-laciniate, diffuse lobes, which are ciliate, and beset above with very long whitish fibres, in California, *Menzies !*

26. P. *detonsa*, Fr. Th. cartilagineous, substellate, naked, glaucous-fuscescent (and fuscous); whitish on the under side with black fibres; laciniæ narrow, linear, somewhat convex, digitate-multifid, often semi-terete, very densely crowded together and imbricated; apoth. subsessile, margin at length crenate, and leafy, disk plane, becoming dark-fuscous. *Fr. Syst. Orb. Veg. fide ipsius. P. Novæ Angliæ, Tuckerm. in litt. olim. P. aquila, Muhl. Catal.*

Rocks and trees, New England. Ohio, *Mr. Lea !* Near to P. aquila. I have not seen Fries's description.

27. P. *pulverulenta*, Fr. Th. cartilagineous, substellate, pruinose-cinereous; black on the under side and hispid-tomentose; laciniæ linear, multifid, approximate; apoth. sessile, margin tumid, entire, or squamulose-foliose, disk plane, black-fuscous, subpruinose. *Fr. Lichenogr. p.* 79. *P. pulverulenta, venusta, & muscigena, Ach.* — *β. leucoleiptes*, Tuckerm.; the whole thallus white-farinose-pruinose, lobes radiant, margins interruptedly inflexed and pulverulent; apoth. subsessile, disk depressed, white-pruinose, margin subduplicate, the external border foliose or entire. *Lichen leucoleiptes, Muhl. in herb.*

Willd.! *P. venusta*, *Hals. & Auct. Amer.* *P. pulverulenta*, *Muhl. Tuckerm. Lich. N. E. l. c.*

Trunks, rocks, and upon mosses; Bear Lake and elsewhere in Arctic America, *Rich.* (Herb. Hook. !). — *β*, trunks and rocks; New England to Pennsylvania ! often isidioid-efflorescent.

28. P. *hypoleuca*, Muhl. Th. cartilagineous, substellate, glabrous, naked, glaucous-virescent (and white); very white on the under side, with scattered black fibres; laciniæ sublinear, approximate, imbricate, multifid, plano-convex, margins naked; apoth. elevated, disk at length black, naked, with an inflexed, crenulate or foliose margin. *Muhl. Catal. p.* 105, *& Eaton Man. Bot. p.* 516. *Tuckerm. Further Enum. l. c.* *P. speciosa*, *β. hypoleuca*, *Ach. ! Syn. p.* 211.

Trunks, fertile. Pennsylvania, *Muhl. !* and northward to New England.

29. P. *speciosa*, Ach. Th. cartilagineous-membranaceous, substellate, glabrous, greenish-glaucous (and white); very white beneath, with numerous pale fibres; laciniæ linear, somewhat concavo-plane, imbricate, incised-ramose, crenate, ciliate-fibrillose, margins often ascendant, green-pulverulent; 'apoth. subsessile, margin incurved, crenate, disk rufous-fuscous, nearly naked.' *Fr. Lichenogr. p.* 80.

Trunks and mossy rocks in woods, infertile; New England. Pennsylvania, *Muhl.*

30. P. *congruens*, Ach. Th. coriaceous-membranaceous, whitish-pallescent; on the under side cinereous-fuscescent, with fibres of the same color; laciniæ laxly-imbricate, flexuous, multifid, recurved at the margins, convex, becoming more plane in the circumference, crenate; apoth. elevated, concave, livid-fuscescent, subpruinose, with a thin, inflexed, at length flexuous margin. *Ach. Lichenogr. p.* 491. *Swartz Lich. Amer. p.* 5 *& t.* 4. *Ach. Syn. p.* 207.

Trunks, New England; *Swartz*, *l. c.* I have a Lichen from the White Mountains resembling this, except that the under side as well as the fibres are black.

31. P. *stellaris*, Wallr. Th. subcartilagineous, naked, not pruinose, glaucescent; whitish on the under side, with dark fibres; laciniæ sublinear, multifid; apoth. sessile, disk fuscous-black, subpruinose, margin somewhat tumid, subentire. *Fr. Lichenogr. p.* 82. — *α.* (*stellari-expansa*), Fr.; th. stellate-expanded, fibres shorter. *Fr. l. c.* *P. stellaris*, *aipo-*

lia, & *anthelina*, *Ach.* — β. *hispida*, Fr.; laciniæ ascendant, hispid on the margins, or tubulose-inflated. *Fr. l. c. Borrera tenella*, *Ach.* — γ. (*tribracia*), Fr.; laciniæ ascendant, squamulose, sparingly fibrillose, pulverulent at the apices. *Fr. l. c. Lecanora tribracia*, *Ach. part.*

Trunks, dead wood, and rocks, very common; New England. New York, *Torrey*. Pennsylvania, *Muhl.* Illinois, *Russell!* Northward to Arctic America, *Rich.*

32. P. *cæsia*, Ach. Th. subcrustaceous-membranaceous, substellate, gray (and cinerascent), besprinkled with gray soredia; pale on the under side; laciniæ linear, somewhat convex, subpinnatifid, ciliate-fibrillose; apoth. sessile, margin thin, somewhat inflexed, entire, disk at length naked, black. *Fr. Lichenogr. p.* 83. — α. (*stellata*), Fr.; laciniæ stellate-expanded, fibres shorter, soredia regular; *P. cæsia*, *Ach.*; and the laciniæ sometimes very narrow. *Fr. l. c. P. dubia*, *Fl.* — β. (*squamulosa*), Fr.; laciniæ squamulose, short, obsoletely fibrillose. *Fr. l. c. Lecanora tribracia*, *Ach. part.*

Rocks, stones, and dead wood, fertile; New England. New York, *Halsey*. Pennsylvania, *Muhl.*

33. P. *obscura*, Fr. Th. submembranaceous, orbicular, not pruinose, greenish, becoming livid-fuscous when dry; black and fibrillose on the under side; laciniæ sublinear, somewhat plane, incised-multifid (often sorediiferous, or the margins pulverulent); apoth. sessile, very entire, disk naked from the first, black-fuscous. *Fr. Lichenogr. p.* 84. *P. cycloselis*, *Ach.* — β. *ulothrix*, Fr.; laciniæ linear, subciliate, apoth. fibrillose below. *Fr. l. c. P. ulothrix*, *Ach.*

Trunks, dead wood, &c., and passing into several degenerate states; New England. New York (α and β), *Halsey*. Pennsylvania (β), *Muhl.* Ohio (β), *Mr. Lea!* Northward to Arctic America (α), *Rich.* — A very distinct species detected recently by Mr. Oakes (P. Tuckermani, Oakes ms.) may be referred to here. Resembling generally small greenish forms of P. parietina, this differs in the foliose-lobate margins of the apothecia, which are also fibrillose beneath, as in P. obscura, β. It is common on trunks about Boston (*Oakes*, *Tuckerman*), and I have found it on rocks at the White Mountains. It was sent from Ohio by the late *T. G. Lea*, *Esq.* (Herb. Russell!), and I have North Carolina specimens from *Mr. Curtis*. (What is P. *fibrosa*, Fr., referred to incidentally, Lich. pp. 75, 97?)

SECT. II. The subfoliaceous at length subgranulose thallus arising from a fibrillose hypothallus, which is adnate to the matrix.

Subsect. III. PYXINE, Tuckerm.

34. P. *sorediata*, Tuckerm. Thallus subcrustaceous-foliaceous, laciniate-multifid, from green becoming glaucescent, and cinerascent; black on the under side, and thickly clothed with greenish-nigrescent fibres; laciniæ sublinear, canaliculate, incised, obtuse, irregularly imbricate, and concrete at the centre (often sorediiferous); apothecia at first pale, and concave, becoming black, convex, and finally proliferous-papillate and irregular. *Lecidea, Ach. Syn. p.* 54. *Tuckerm. Further Enum. l. c. Lichen alomatus, Willd. herb.! Pyxine, Fr. cit. Eschw.*

Trunks, common (abundantly fertile in mountain forests), and also on rocks; New England. Pennsylvania, *Muhl.!* Rocky Mountains, *Herb. Hook.!* (Southward to Texas!) I have not seen the description of Fries, and am uncertain whether his Pyxine is founded on our Northern Lichen (which is probably what Acharius described), or on the West Indian and South American Lecidea sorediata of Eschweiler. The latter seems distinct, and has been separated as Circinaria Berteriana by Feé (Crypt. Exot. p. 128). Our Lichen appears to me a modification of Parmelia, near to Amphiloma, Fr. The apothecia have some of the features of those of Umbilicaria, and illustrate Fries's observation, that this genus is related to Parmelia.

Subsect. IV. AMPHILOMA, Fr.

35. P. *rubiginosa*, Ach. Thallus membranaceous, suborbicular, not pruinose, livid-glaucous, laciniate-multifid at the circumference; hypothallus indeterminate, tomentose, bluish-black; apothecia reddish-brown, with an incurved, crenate margin. *Fr. Lichenogr. p.* 88. — *β. conoplea*, Fr.; the centre of the thallus passing into a bluish, pulveraceous-granulose crust; 'apothecia symphycarpeous, immersed, convex, granulose-marginate.' *Fr. l. c. P. conoplea, Ach.*

Rocks and trunks. *β* has occurred at the White Mountains; and I have *α* from the South.

36. P. *Russellii*, Tuckerm. Th. orbicular, coriaceous-membranaceous, minutely farinose-granulose, submonophyllous, irregularly radiant, pale-fuscescent-lead-colored; laciniæ somewhat ascendant; hypoth. indeterminate, of very short white fibres becoming lead-colored at the margins; apoth. (central, very numerous) reddish-chestnut and nigres-

cent, with a thick, inflexed, at length rugose, thalline margin. *Tuckerm. Enum. Lich. N. Amer. p.* 50.

Trunks and dead wood; Hingham, *Mr. Russell.* Ipswich, *Mr. Oakes.*

37. P. *Cronia*, Tuckerm. Th. orbicular, membranaceous, smooth, radiant, submonophyllous, dark-bluish becoming pale-lead-colored; laciniæ plane, with elevated, darker margins (beset with elevated, often blackish points, and isidioid branchlets); hypoth. determinate, dark cærulescent.

Rocks among mosses, common on the coast of Massachusetts, and resembling a Collema; infertile. It is very distinct from P. plumbea.

38. P. *lanuginosa*, Ach. Th. membranaceous, white, pruinose; in the circumference lobed and crenate; hypoth. tomentose, bluish-black; apoth. rufous-fuscous, with a pulverulent thalline margin. *Fr. Lichenogr. p.* 88. — *β. (granulosa)*, Fr.; thallus, at the centre, or mostly, granulose-pulverulent. *Fr. l. c.* — * *(leproso-byssina)*; the whole thallus dissolved into a leprous-byssine mass. *Fr. l. c. Lepraria, Ach.*

Rocks in the mountainous districts and on the coast of New England; rarely fertile.

Subsect. V. Psoroma, Fr.

39. P. *microphylla*, Stenh. Scales of the thallus cartilagineous, imbricate, crenate, livid-cinereous, compacted at length into a cinereous crust; hypothallus becoming black; apothecia superficial, disk fuscous-black, finally convex, and excluding the thalline margin. *Fr. Lichenogr. p.* 90. *Lecidea, Ach.*

Rocks in woods, fertile; New England.

40. P. *triptophylla*, Fr. Scales of the thallus membranaceous, livid-fuscescent, at first stellate-expanded, and lacerate-dissected, at length granulose-coralline; hypoth. bluish-black; apoth. somewhat immersed, disk rather plane, rufous-fuscous, margin erect, persistent. *Fr. Lichenogr. p.* 91. — *α. coronata*, Fr.; apoth. produced from the thallus, with a thalline margin, and either simple or symphycarpeous. *Fr. l. c. Lecanora brunnea, Ach. part.* — *β. Schraderi*, Schær.; apoth. produced from the hypothallus, plane, destitute of a thalline margin. *Fr. l. c.* — *γ. corallinoides*, Fr.; crust blackish from the predominant hypothallus, squamules wholly coralline. *Fr. l. c.*

Rocks in woods; New England. New York, *Halsey.* Pennsylvania, *Dill.* Northward to Arctic America, *Rich.*

41. P. *Hypnorum*, Fr. Scales of the thallus minute, imbricate, granulate-crenulate, somewhat yellowish-fuscescent; pale on the under side; apoth. sessile, dilated, disk membranaceous, fulvous-fuscescent, with an elevated, granulose, thalline margin. *Fr. Lichenogr. p.* 98. Icon, *Laur. in Sturm's Fl. t.* 18.

On the earth, growing over mosses and twigs, in alpine districts. White Mountains, frequent upon Salix Uva-Ursi, on Mount Pleasant, &c., fertile. Northward to Arctic America, *Rich.*

Sect. III. Thallus crustaceous, lobate at the circumference, or wholly squamulose and effigurate.

Subsect. VI. Placodium, Fr.

42. P. *straminea*, Wahl. Thallus crustaceous, plicate-radiose, straw-colored; laciniæ convex, teretish, contiguous; apothecia plane, reddish-fuscous, with a tumid thalline margin. *Fr. Lichenogr. p.* 109.

Rocks. Greenland, *Fries.* And elsewhere in Arctic America, *Rich.*

43. P. *saxicola*, Ach. Th. cartilagineous, appressed, areolate-squamulose, pale-greenish; the circumference of somewhat plane, radiose-lobate, concrete laciniæ; apoth. appressed, disk yellowish-fulvous, margin thin, at length crenate. *Fr. Lichenogr. p.* 110. *Lecanora galactina, Ach.*

Rocks and stones, fertile; New England. New York, *Halsey.*

44. P. *chrysoleuca*, Ach. Th. cartilagineous, subfoliaceous, crenate-lobate, greenish-straw-colored; fuscescent on the under side; apoth. appressed, disk golden-fulvous, and dark orange-red, with a thin, flexuous, evanescent margin *Fr. Lichenogr. p.* 113. *Lecanora rubina, Ach. Squamaria, Hoffm. Tuckerm. Lich. N. E. l. c.*

Rocks, New England. Northward to Arctic America, *Rich.* (Herb. Hook.!).

45. P. *oreina*, Ach. Th. crustaceous-adnate, areolate-verrucose, pale-greenish-straw-colored; at the circumference radiose-lobate, plane, incised, black-marginate; apoth. depressed, disk somewhat tumid, black, margin obtuse, very entire. *Fr. Lichenogr. p.* 113. *P. straminea, var. Ach. Mey. Tuckerm. Further Enum. l. c.*

Rocks, throughout New England; fertile.

46. P. *elegans*, Ach. Th. stellate-radiose, appressed, dark orange-

red, naked on both sides; laciniæ somewhat discrete, linear, convex, contiguous, flexuous; apoth. of the same color, very entire. *Fr. Lichenogr. p.* 114.

Rocks and stones near the sea, fertile; New England. Northward to Newfoundland, *Pylaie*, Point Lake, &c., *Rich.*, and Melville Island, *R. Br.*

47. P. *murorum*, Ach. Th. crustaceous, adnate, contiguous, in the circumference radiose-plicate, pale yellow; white underneath; apoth. sessile, disk naked, dark yellow, with a thin, entire, somewhat flexuous margin. *Fr. Lichenogr. p.* 115. — *β. miniata*, Fr.; th. verrucose, less and more narrowly radiose, naked, vermilion-colored. *Fr. l. c. Lecanora, Ach.*

Rocks and stones near the sea, New England, fertile. — *β*, Pennsylvania, *Muhl.* Arctic America, *Rich.*

Subsect VII. Psora, Fr.

48. P. *molybdina*, Wahl. Thallus crustaceous, areolate-verrucose, radiate-plicate, dark-fuscous; white beneath; laciniæ of the circumference linear; apothecia innate, disk urceolate, blackish-fuscous, marginate, with a tumid thalline margin. *Fr. Lichenogr. p.* 126.

Rocks. Greenland, *Fries.*

49. P. *cervina*, Sommerf. Th. areolate-squamaceous; the scales crustaceous, subpeltate, repand or lobed, from greenish becoming livid-chestnut; on the under side white; apoth. at first immersed, marginate, at length protuberant, disk rufous-fuscous. *Fr. Lichenogr. p.* 127. — *β. squamulosa*, Fr.; th. chestnut-tawny; apoth. naked, thalline margin thin or wanting. *Fr. l. c.*

Rocks. White Mountains. Northward to Arctic America, *Rich.*

50. P. *chrysomelæna*, Ach. (sub Lecanora). Th. crustaceous, areolate, yellow; areolæ flat, submembranaceous, somewhat lobate, here and there discrete; apoth. appressed, disk plane, sanguineous-black, thalline margin elevated, subrugose, at length flexuous. *Ach. Syn. p.* 148.

North America (Pennsylvania?), *Muhl.*, *Ach.*

Sect. IV. Thallus crustaceous, uniform.

Subsect. VIII. Patellaria, Fr.

51. P. *pallescens*, Fr. Crust subtartareous, rugose-granulate, glauces-

cent; hypothallus pale; apothecia tumid, disk plane, pale, innate-pruinose, with an erect, entire, persistent margin. *Fr. Lichenogr. p.* 132. *Lecanora Parella, β. Ach. Lichen pallescens, L. Spec. Pl.* — *β. Parella*, Fr.; crust amylaceous-tartareous, plicate-verrucose, milk-white, disk at length chinky or verrucose. *Fr. l. c. Lecanora Parella, Ach. Lichen Parellus, L. Mant.*

Trunks, rails, stones, &c., ascending to alpine districts. — *β*, rocks near the sea and large lakes. New England. New York, *Torrey*. Pennsylvania, *Muhl.* Northward to Arctic America, *Rich.*

52. P. *tartarea*, Ach. Cr. tartareous, granulate-conglomerate, glaucescent; hypoth. pale; apoth. adnate, disk plane, rugulose, pale-yellowish-flesh-colored, with an inflexed, entire margin. *Fr. Lichenogr. p.* 133. — *β. frigida*, Ach.; hypothallus confused with the thallus; crust at length granulate, whitish; apoth. smaller, reddish-flesh-colored. *Fr. l. c.*

Rocks; *β* incrusting twigs, mosses, lichens, &c., and ascending to alpine districts; New England. New York, *Halsey*. Arctic America, *Grev.* (Pl. W. Greenl.).

53. P. *rubra*, Ach. Cr. subcartilagineous, smoothish, at length granulate-pulverulent, glaucescent; hypoth. pale; apoth. adnate, disk concave, red, with a tumid, inflexed, crenulate margin. *Fr. Lichenogr. p.* 134. *Lecanora, Ach.*

Trunks in mountainous districts; New England. Pennsylvania, *Muhl.*

54. P. *oculata*, Fr. Cr. cartilagineous-tartareous, rugose, uneven, papillose, glaucescent; hypoth. pale; apoth. sessile, concave, disk subfuscous, with an elevated, very entire margin, which is whiter than the thallus. *Fr. Lichenogr. p.* 135. — *β*; thallus isidioid, branched; apoth. becoming black. *Fr. l. c. Isidium oculatum, Ach. Turn. & Borr. Lich. Brit. p.* 103.

Trunks in mountainous districts; White Mountains. Northward to Arctic America, *Rich., Hook.*

55. P. *subfusca*, Fr. Cr. cartilagineous, at first contiguous, smooth, becoming chinky and granulate, glaucescent; hypoth. macular; apoth. adnate, disk plano-convex, subfuscous, whitish within, with an erect margin colored like the thallus. *Fr. Lichenogr. p.* 136 (*excl. P. albella*). — *α. discolor*, Fr.; cr. as above; apoth. regular, disk thickish, always naked (red, rufous, fuscous, or black), margin entire, or at

length rugose. *Fr. l. c. Lecanora subfusca, & L. epibryon, Ach.* — *β. distans*, Fr.; cr. thin; apoth. orbiculate, margin elevated, crenulate, disk thin, pale, at first pruinose, finally naked. *Fr. l. c. Lecanora distans, Ach.*

Trunks, dead wood, rocks, and stones. — *β*, trunks. New England. New York, *Torrey*. Pennsylvania, *Muhl.* Northward to Arctic America, *Rich.*

56. P. *albella*, Ach. Cr. cartilagineous, thin, milk-white; apoth. orbiculate, tumid, pale-flesh-colored, whitish-pruinose, margin very entire, subevanescent. *Ach. Syn. p.* 168. *Fr. Summ. Fl. Scand. P. subfusca, γ. Fr. Lichenogr. p.* 139. — *β. angulosa*, Fr.; apoth. aggregated, angulose-irregular, disk livid-fuscous, glaucous-pruinose, with a flexuous, subpersistent margin. *Fr. Summ. Fl. Scand. P. subfusca, δ. Fr. Lichenogr. p.* 139. *P. angulosa, Ach.*

Trunks; New England. New York (*α* and *β*), *Halsey.*

57. P. *cæsio-rubella*, Ach. Cr. thin, softish, white; apoth. scattered (rather large), disk plane, becoming at length somewhat tumid, pale-reddish and fuscescent, at first cæsious-pruinose, equalling the tumid very entire margin. *Ach. Syn. p.* 267.

Trunks; New England. New York, *Halsey*. Pennsylvania, *Muhl.*

58. P. *atra*, Ach. Cr. cartilagineous, at length granulose-verrucose, glaucescent; hypoth. black; apoth. sessile, disk at length somewhat tumid, polished, very black, within black, with an elevated, persistent, subentire margin. *Fr. Lichenogr. p.* 141.

Rocks and stones; New England. New York, *Halsey*. Pennsylvania, *Muhl.* Arctic America, *Rich.*

59. P. *cinerea*, Fr. Cr. subtartareous, areolate-rimose, glaucous-cinereous; hypoth. black; apoth. innate, disk naked, nigrescent, pale within, with a black, obtuse, subelevated thalline margin. *Fr. Lichenogr. p.* 142. *Urceolaria, Ach.*

Rocks and stones, very common, and passing into many varieties. An ochraceous state (Urceolaria Acharii, Ach.) occurs not uncommonly about mountain streams. New England. New York, *Halsey.* Arctic America, *Rich.*

60. P. *badia*, Fr. Cr. cartilagineous, rimose-areolate, subsquamulose, dark-olive; hypoth. black; disk naked, polished, fuscous-black, with an entire, persistent thalline margin. *Fr. Lichenogr. p.* 147.

Rocks and stones (granite), ascending to alpine districts; New England. Arctic America, *Rich.* Areolæ sometimes dispersed and squamaceous, with subimmersed, punctiform (imperfect) apothecia. Such a state, according to Fries, is the Endocarpon smaragdulum of some authors; and a similar one, tinged dark red by the oxide of iron, the Endocarpon Sinopicum, Wahl. The former is common in New England, and occurs in New York, *Halsey.* The latter is frequent on alpine and subalpine rocks on our higher mountains.

61. P. *sophodes*, Ach. Cr. tartareous, verrucose-granulate, from green becoming fuscescent; hypoth. black; disk opake, unpolished, fuscous-nigrescent, thalline margin thick, at length rugulose. *Fr. Lichenogr. p.* 149. *Lecanora, Ach.* — *β. exigua*, Fr.; small; crust fuscous-cinerascent; hypoth. obsolete; margins of the apothecia whitish, and disappearing. *Fr. l. c. Lecanora, Ach.*

Trunks and dead wood; New England. New York (α and β), *Halsey.* Pennsylvania (α), *Muhl.* Arctic America (β), *Rich.*

62. P. *ventosa*, Ach. Cr. tartareous, rimose-areolate, pale-yellow; hypoth. white; apoth. appressed, at length irregular, disk somewhat convex, dark-brownish-red, with a thin, pale, very entire margin. *Fr. Lichenogr. p.* 153. *Lecanora, Ach.*

Alpine and subalpine rocks; White Mountains. Newfoundland, *Pylaie*, and northward to Arctic America, *Rich.*

63. P. *varia*, Fr. Cr. cartilagineous, areolate-verrucose, yellowish-green, becoming ochroleucous; hypoth. smooth, macular; apoth. sessile, disk polished, yellowish-flesh-colored, or discolored, with a thin, erect, entire margin. *Fr. Lichenogr. p.* 156. — *α.* Fr.; apoth. scutelliform, plano-concave, with a persistent, sometimes crenulate, or pulverulent thalline margin. *Fr.! l. c. P. varia, Ach.* — *β. symmicta*, Fr.; disk of the apothecia somewhat excluding the paler, very entire margin, from pale-yellowish becoming fuscous. *Fr.! l. c.* — *γ. sepincola*, Fr.; apoth. somewhat immersed, convex, immarginate, from fulvous becoming black. *Fr. l. c. Lecidea, Ach.* — *δ. polytropa*, Fr.; crust areolate and granulate; margins of the apothecia pale, entire, somewhat flexuous. *Fr. l. c. Lecidea, Ach.*

Dead wood, stones, and trunks; New England. New York, *Halsey.* Pennsylvania, *Muhl.* — *β*, granite rocks in mountainous districts; New England. Arctic America, *Rich.*

64. P. *vitellina*, Ach. Cr. tartareous, granulose-coacervate, dark-reddish-yellow; hypoth. macular, white; apoth. sessile, disk yellow becoming fuscous, margin simple, thin, erect, entire, at length of the same color. *Fr. Lichenogr. p.* 162. *Lecanora, Ach.*

Dead wood and rocks; New England. Pennsylvania, *Muhl.*

65. P. *fulva*, Schwein. (sub Lecanora). Cr. cartilagineous, chinky and granulate-verrucose, sulphureous or pallescent, upon a blackish hypothallus; apoth. sessile, disk reddish-orange, immarginate, with a thick, inflected, at length flexuous margin. *Lecanora fulva, Schwein. in Hals. Lich. N. Y. l. c. p.* 13. *Tuckerm. Lich. N. E. l. c.*

Trunks; New England. New York, *Halsey.*

66. P. *cerina*, Ach. Cr. at first contiguous, at length granulate, cinereous, upon a bluish-black hypothallus; apoth. sessile, disk immarginate, somewhat wax-colored, with a thin, equal, opake, entire thalline margin. *Fr. Lichenogr. p.* 160. *Lecanora, Ach.*

Trunks, rocks, and stones; New England. Pennsylvania, *Muhl.*

Subsect IX. Urceolaria, Fr.

67. P. *glaucoma*, Ach., Fr. Crust tartareous, contiguous, rimose-areolate, glaucous-white; hypothallus white; apothecia innate, disk pale-flesh-colored, pruinose, at length convex, and becoming blackish, with a very entire, evanescent thalline margin. *Fr. Summ. Fl. Scand. P. sordida, Fr. Lichenogr. p.* 178. *Lecanora glaucoma, Ach.*

Rocks (especially granite). New York, *Halsey.* Arctic America, *Rich.*

68. P. *verrucosa*, Ach., Fr. Cr. cartilagineous, verrucose, naked, glaucous-white; hypoth. white; disk immersed in the verrucæ, concave, blackish, subpruinose, the proper margin connate with the convex thalline margin. *Fr. Lichenogr. p.* 186. Icon, *Laur. in Sturm's Fl. t.* 21. — *α. Urceolaria*, Fr.; normal. *Urceolaria verrucosa, Ach.* — *β. Pertusaria*, Fr.; verrucæ closed, disk prominent like a black ostiole. *Porina glomerata, Ach.*

Incrusting dead mosses and sticks, in alpine districts; White Mountains.

69. P. *calcarea*, Ach., Fr. Cr. subcartilagineous, areolate-verrucose, glaucescent (often mealy and white); disk immersed in the areolæ, from concave becoming plane, blackish, cæsious-pruinose, with a

thin, at length discrete, entire proper margin; thalline margin somewhat prominent, subentire, or rugose-crenate. *Fr. Lichenogr. p.* 187. *Urceolaria, Ach.*

Limestone, and from this passing to other rocks; New England. New York, *Halsey.*

70. P. *scruposa*, Sommerf. Cr. tartareous, rugose-granulate, glaucous-cinerascent; hypoth. white; apoth. immersed, disk urceolate, cæsious-black, with a connivent, cinerous-blackish proper margin, which is at first covered by the crenate thalline margin. *Fr. Lichenogr. p.* 190. *Urceolaria, Ach.* — *β. bryophila*, Ach.; cr. rugose; apoth. smaller, disk emergent, urceolate, with a contracted mouth, thalline margin subevanescent. *Fr. l. c. Gyalecta, Ach.*

Rocks, stones, dead wood, trunks, and on the earth; New England. — *β* incrusting mosses; Pennsylvania, *Muhl.* Arctic America, *Rich.*

X. THELOTREMA, Ach.

Apothecia subconical-truncate, at length open, urceolate-scutelliform; a discrete, lax, membranaceous, lacerate-dehiscent, interior exciple veiling a rigescent disk. Thallus crustaceous.

T. *lepadinum*, Ach. Disk blackish, at first cæsious-pruinose. *Fr. Lichenogr. p.* 428. *Schær. ! Spicil. p.* 67.

Trunks, somewhat rare; New England. Arctic America, *Rich.* (Herb. Hook. !). Our Lichen, as well as that of Arctic America, agrees with the European; and the species is found also in Brazil (*Eschweiler*).

XI. GYALECTA, Ach., Fr.

Apothecia orbiculate, urceolate, at first closed, then variously dehiscent, the elevated, discrete, colored border of the exciple surrounding the disk. Disk at first included, like a nucleus, and gelatinous, becoming at length open, explanate, indurated. Thallus horizontal, crustaceous, somewhat tartareous.

G. *cupularis*, Schær. Apothecia radiate-dehiscent, urceolate-open; border orbicular, elevated, tumid, pale, disk pale-flesh-colored. *Fr. Lichenogr. p.* 195.

Rocks (especially limestone and sandstone, Fr.) and on the earth. New York, *Halsey.* Pennsylvania, *Muhl.*

Tribe II. LECIDEACEÆ, Fr.

XII. STEREOCAULON, Ach.

Apothecia placed upon a thalline stratum, which forms a more or less evident, evanescent (spurious) thalline margin, becoming plane, with an obscure proper margin, and at length cephaloid and immarginate, solid. Thallus vertical, caulescent, mostly solid (*podetia*), supporting a horizontal, squamulose-granulose thallus, and arising sometimes from a horizontal, adnate, granulose thallus.

The apothecia are often quite those of Parmelia, but they also occur subimmarginate from the first, or with only an obscure proper margin, as observed by Schærer and Eschweiler, and the genus seems properly nearest to Biatora, and related through this to Lecidea. In this view, Cladonia must be taken for the highest type of Lecideaceæ; and the fistulous podetium, analogous certainly (Fr. Lich. p. 14) to the tubulose thallus of some Cetrariæ, and in Cladonia turgida, if I am not mistaken, evidently formed by constriction of the ascending foliaceous thallus of that species, must be considered as indicating a higher rank than the solid podetium; this last being rather a branched *stipe*, as is suggested by a comparison of Stereocaulon Fibula with Biatora Byssoides. And, adopting a somewhat wider sense for Eschweiler's remark, that Cladonia unites in itself the horizontal and the vertical thallus, we might, in the point of view that we have chosen, see reason to agree with him that this genus is even the highest development of Lichenose vegetation; or to venture, at least, the suggestion, that no genus, which does not include the horizontal type, should seem to be the most perfect *typical* representative of Lichenes. Fries, from whose profound conclusions we are far from prepared to depart, attributes indeed to Usnea (l. c. pp. 9, 17, 198) the highest rank, and, where he considers the genera as falling into parallel series, he, in this view, assigns the position to Usnea, Stereocaulon, and Sphærophoron. But if there is evidently a distinction between the highest *typical* development and the highest *actually attainable* development, and the former represent the most perfect condition of the plant, or genus, *per se*, as a distinct real or assumed existence in nature, — as the latter is representative of extreme tendencies of the vegetation in question to ascend to a higher than its typical structure, — Usnea, &c., may be taken as representing

the *extreme* development of Lichenes, and Cladonia, or some other genus expressing the horizontal type, as representing their *typical* perfection. — S. *ramulosum*, Ach., a mostly tropical species, with densely fibrillose podetia, and terminal, subglobose apothecia, inhabits North America, according to Acharius and Muhlenberg; but it is probable, only the southern part.

SECT. I. Podetia solid, filamentous within; apothecia normally fuscous.

* Squamules foliaceous, or fibrillose.

1. S. *tomentosum*, Fr. Podetia lax, terete, very much branched and the branches somewhat recurved, clothed with a dense, whitish, spongy tomentum; squamules somewhat rounded, incised-crenate (becoming phylloid-granulose), cinereous-cæsious; apothecia minute, lateral, at length globose. *Fr. Lichenogr. p.* 201.

On the earth and stones in the lower regions of the White Mountains, and ascending; fertile. Northward to Arctic America, *Herb. Hook.!*

2. S. *corallinum*, Fr. Podetia lax, a little compressed, very much branched, glabrous (many conjoined at the base into a dense, at first digitate-divergent sod); squamules fibrillose, somewhat digitate-ramose, cinereous-cæsious; apoth. scattered or conglomerate (rather large), finally globose. *Fr. Lichenogr. p.* 201. *S. dactylophyllum, Floerk.!*

Stones, in the lower regions of the White Mountains; fertile.

3. S. *paschale*, Laur. Podetia lax, rather slender, somewhat compressed, very much branched, subglabrous (many commonly crowded thickly together, but not cæspitose-conjoined); squamules phylloid-granulose, crenate, conglomerate, glaucous; apoth. subterminal, dilated, plane. *Fr. Lichenogr. p.* 202. *S. paschale, Ach. part. Lichen paschalis, L. fide Fr.*

Stones, and on the earth in large patches, in the lower regions of the White Mountains; and ascending to alpine districts. Common also on the coast; but the genus is peculiarly montane. The present species was formerly considered as including most of those here described, and the following stations are therefore so far uncertain. New York, *Torrey*. Pennsylvania, *Muhl.* Northward to Canada, *Michaux;* Newfoundland, *Pylaie;* the Saskatchawan, &c., *Rich.;* Greenland, *Gieseke;* and Melville Island, *R. Br.*

4. S. *condensatum*, Laur. Podetia erect, terete, scarcely branched, clothed with a thin, white-incarnate tomentum; squamules roundish, teretish, or confluent, glaucous; apoth. terminal, dilated, plane, subpeltate. *Fr. Lichenogr. p.* 203. *S. Meissnerianum, Floerk. !*

Stones and rocks, in the lower regions of the White Mountains; somewhat rarely fertile. Occurring also in the deliquescent, degenerate state called by Acharius S. Cereolus (Meth. t. 7, p. 1). The horizontal thallus at the base is persistent, and often conspicuous.

** Squamules verrucæform, rounded, or angulate.

5. S. *denudatum*, Floerk. Podetia erectish, terete, somewhat sparingly branched above, below denudate, glabrous; granules roundish, thick, cinerascent, at length almost plane, crenate-lobate; apoth. lateral, minute, somewhat plane. *Floerk. ! D. Lich. p.* 13. *Fr. Lichenogr. p.* 204. *S. glaucescens, Tuckerm. Lich. N. E. l. c.*

Rocks; from Greenland, *Dill.*, to New England, where it is common in mountainous, and ascends to subalpine districts. Southward to Pennsylvania, *Dill.*

6. S. *nanum*, Ach. Podetia erect, slender, fastigiate-ramose, below denudate, above very finely pulverulent; granules verrucæform, minute, greenish-pallescent, floccose; apoth. small, lateral, convex. *Fr. ! Lichenogr. p.* 205.

Fissures of rocks, and on stones, in the lower regions of the White Mountains; fertile.

Sect. II. Pilophoron, Tuckerm. Podetia cartilagineous-subfilamentous, or araneous-fistulous within; apothecia subimmarginate, black.

7. S. *Fibula*, Tuckerm. Crust persistent, appressed, subsquamaceous-granulate, bright green; podetia (solid), erect, terete, simple, somewhat corticate with the green squamaceous granules, at length subdenudate, glabrous; apoth. (lateral, minute, somewhat plane, subimmarginate, and) terminal, mostly solitary, at first depressed-globose, immarginate, at length rather inflated, dark-greenish-nigrescent becoming black.

Moist rocks along streams in mountain forests; White Mountains. Rugose, nigrescent cephalodia (certainly abortive apothecia) occur commonly in the crust, resembling similar ones in S. condensatum. Barren podetia terminated often with powdery green pulvinules, as in S. Cereolus, Ach. Apothecià solid, as in the next, the disk placed upon

a paler stratum. S. Cereolus, as described by Borrer, and figured in E. Bot. Suppl. t. 2667, is certainly very near the present section, and agrees in many respects with the species under notice. The apparent difference of structure in the apothecia of this and of the next species from Cladonia, Stereocaulon, and Biatora is one so anomalous, that I prefer to leave them in this place, to which, indeed, their whole habit would seem to refer them.

8. S. *aciculare*, Tuckerm. Crust persistent, of effuse, roundish, whitish granules; podetia erect, terete, smooth, elongated (fistulous and araneous within), divided at length irregularly into erect, subfastigiate, at length denudate branches; granules verruculose, pale-cinereous; apoth. at first subconical-globose, immarginate, often conglomerate, from dark-greenish-nigrescent becoming black. *Bæomyces, Meth. t.* 8, *f.* 4, *dein Cenomyce, Ach. Cladonia, Auct. Stereocaulon, Mihi, Enum. Lich. N. Amer. p.* 52.

On the earth; Northwest Coast, *Menzies! Douglas*, in herb. Hook.! Rocky Mountains, *Herb. Hook.!* — New York, *Halsey*. Pennsylvania, *Muhl.* Certainly a congener of the last. Fries remarks incidentally (Lichenogr. p. 242), that the apothecia are almost those of Biatora. Rugose cephalodia, like those of the last, occur also in the crust of this species, and at the bases of the podetia. Sommerfelt (Suppl. Fl. Lapp. p. 126) remarks that these cephalodia occur also in S. paschale, S. corallinum, and S. denudatum.

XIII. CLADONIA, Hoffm.

Apothecia orbiculate, submarginate; becoming at length inflated, cephaloid, and immarginate; empty. Disk open, at length protuberant and reflexed, concealing the proper exciple. Horizontal thallus squamulose-foliaceous or crustaceous, from which arises a vertical, caulescent, cartilagineous, fistulous thallus (*podetia*).

Series 1. *Glaucescentes*, Fr. Podetia greenish-glaucous. Apothecia rufous.

1. C. *alcicornis*, Fr. Thallus cæspitose, subfoliaceous, of palmate-laciniate, crenate, glaucous lobules; podetia elongated-turbinate, somewhat verruculose, glabrous, of the same color; scyphi regular, concavo-plane, crenulate; apothecia rufous. *Fr. Lichenogr. p.* 213. *C. Cornucopiæ, Hoffm. Tuckerm. Lich. N. E. l. c.*

Sterile, sandy earth; pine woods. North America, *Floerke!* Common in New England, and fertile. Pennsylvania, *Muhl.* Arctic America, *Hook.* Lobes black-fibrillose at the margins, beneath, in the European Lichen, but naked in 'warm, dry places,' according to Floerke, and in sterile soils, according to Fries. I have never found fibrillose specimens of our plant.

2. C. *turgida*, Hoffm. Th. foliaceous, erectish, laciniate, glaucous, branching into fruticulose, ramose, glabrous podetia, of the same color; the scyphiferous ones turgid, obconico-cylindrical; spurious scyphi immarginate, dentate-radiate; apoth. carneo-rufescent. *Fr. Lichenogr. p.* 214. *Floerk.! Clad. p.* 115. *Cenomyce parecha, Ach.*

Sterile, moist earth, in mountainous districts, fertile; New England. Pennsylvania, *Muhl.* Arctic America, *Rich.*

3. C. *Papillaria*, Hoffm. Th. crustaceous, papillose-granulate, persistent; podetia ventricose-cylindrical, gibbous, glabrous, simple or much branched, glaucous; the branches fastigiate, undivided at the apices, obtuse; apoth. at length convex, rufous. *Fr. Lichenogr. p.* 245. *Floerk.! Clad. p.* 5. Icon, *Laur. in Sturm's Fl. t.* 22. *Pycnothelia, Hook. Br. Fl. Tuckerm. Lich. N. E. l. c.*

Sterile earth in alpine and subalpine districts, White Mountains; fertile. The abnormal state with very short, vesicular podetia, tipped with rufous-fuscous, abortive apothecia, is most common.

Series 2. *Fuscescentes*, Fr. Podetia greenish-fuscous (and cinerascent). Apothecia fuscous.

* *Scyphiferæ*, Fr. Podetia passing into a terminal scyphus, closed with a diaphragm.

4. *C. cæspiticia*, Floerk. Thallus cæspitose, of pale-green, laciniate squamules; podetia very short, glabrous, dilated above (and wanting); apoth. fuscous. *Floerk.! Clad. p.* 8. *Cenomyce, Ach. Syn. p.* 247.

Trunks of trees and rocks, fertile; New England. New York, *Halsey.* (Cf. Fr. Lichenogr. p. 218.)

5. C. *pyxidata*, Fr. Th. squamulose; podetia cartilagineous-corticate, at length verrucose, or furfuraceous, green-cinerascent; the scyphiferous ones turbinate; scyphi cyathiform, dilated; apoth. fuscous. *Fr. Lichenogr. p.* 216. *Cenomyce, Ach.! Syn. p.* 252. — *β. Pocillum*, Ach.; th. of large, thickened lobules; podetia dilated sensibly

upward from a thick base, verrucose with subsquamaceous granules. *Ach. Lichenogr. p.* 535.

On the earth, &c., very common and variable; New England, and westward. New York, *Torrey*. Pennsylvania, *Muhl.* North to the Saskatchawan, &c., *Rich.;* Greenland, *Gieseke;* and Melville Island, *R. Br.* — *β*, in moist crevices of rocks in the mountains of New England; perhaps the handsomest state of the species. A frequent rail-Lichen (Bœomyces scolecinus, Ach., Pycnothelia scol., Tuckerm. Lich. N. E.) is a degeneration. Infertile states are easily confounded with similar states of several other species.

6. C. *gracilis*, Fr. Th. squamulose; podetia cartilagineous-corticate, polished; scyphi somewhat plane; apoth. fuscescent. *Fr. Lichenogr. p.* 218. — *α. verticillata*, Fr.; podetia shorter, all scyphiferous; scyphi dilated, plane, proliferous for the most part from the centre. *Fr. l. c. C. verticillata, Hoffm. Floerk.! Clad. p.* 26. — *β. cervicornis*, Auct.; th. of conspicuous, elongated, erectish, naked, dark-green squamules; podetia as in the next, of which this is the macrophylline state. — *γ. hybrida*, Fr.; podetia longer and larger, mostly scyphiferous; scyphi dilated, and commonly proliferous from the margin. *Fr. l. c.* — *δ. elongata*, Fr.; podetia elongated, mostly subulate or furcate; scyphi diminished, somewhat concave. *Fr.! l. c. Cenomyce gracilis, Ach. Cladonia, Hoffm. Floerk.! Clad. p.* 30. *Tuckerm. Lich. N. E. l. c. Lichen, L.* — * *vermicularis*, Auct.; podetia papyraceous, prostrate, subulate, subsimple, imperforate, white. *C. vermicularis, DC. C. subuliformis, Hoffm. Tuckerm. l. c.* — ** *taurica*, Auct.; podetia papyraceous, erectish, ventricose, ramose, white. *C. taurica, Hoffm. C. subuliformis, β. taurica, Tuckerm. l. c.*

On the earth, most perfect, and in all the varieties, on high mountains; — *γ* being an alpine state, but descending; and * and ** alpine degenerations.† New England and westward. New York (*α*), *Halsey*. Pennsylvania, *Muhl.* North to Point Lake, &c., *Rich.*; and Greenland, *Gieseke*.

7. C. *degenerans*, Floerk. Th. squamulose; podetia cartilagineous-corticate, irregularly proliferous-ramose (glabrous or granulate-furfuraceous), more or less squamulose-exasperate, green-pallescent, becoming

† "Apothecia lateralia, sparsa, atra, thallo innata, eoque submarginata, apoth. Roccellæ aliquo modo accedentia," were observed by Brown in some Arctic American specimens of * (R. Br. in Parry's First Voy. App. p. 307).

blackish and white-spotted at the base; scyphi irregular, cristate-lacerate; apoth. fuscous. *Floerk.! Clad. p.* 41. *Fr.! Lichenogr. p.* 221. *Cenomyce gonorega, Ach.* — *β*; scyphi digitately divided into fastigiate branches, and becoming carious with age. *Fr. l. c. Cenomyce cariosa, Ach.*

On the earth; common in New England. New York, *Halsey.* Pennsylvania, *Muhl.* (Southward to Virginia, *Dill.*)

8. C. *fimbriata*, Fr. Th. squamulose; podetia cylindrical, the whole membranaceous epidermis deliquescing into a fine, glaucous-candicant dust; scyphi cupulæform with an erect margin; apoth. fuscous. *Fr. Lichenogr. p.* 222. *Lichen fimbriatus, L.* — *α*; podetia short, all scyphiferous; scyphi somewhat dentate; apoth. simple. *Fr. l. c. Dill. Musc. t.* 14, *f.* 8. *Lichen fimbriatus, α, L.* — *β. tubæformis*, Fr.; podetia elongated, mostly scyphiferous; scyphi somewhat entire; apoth. symphycarpeous. *Fr. l. c. Lichen fimbriatus, β, L.* — *γ. radiata*, Fr.; podetia elongated, subulate, or the scyphi proliferous-subulate, or obliterated and radiate-fimbriate. *Fr. l. c. Lichen fimbriatus, γ, L.*

On the earth, common in mountainous districts, and fertile; New England. New York, *Halsey.* Pennsylvania, *Muhl.* Northward to Arctic America, *Rich.*

9. C. *cornuta*, Fr. Th. squamulose; podetia cylindrical, somewhat ventricose, the epidermis cartilagineous and persistent below, membranaceous and becoming powdery-deliquescent above; scyphi narrowed, rather plane, with an incurved, somewhat entire margin; apoth. fuscous. *Fr. Lichenogr. p.* 225. *Lichen cornutus, L.*

Trunks among mosses, dead wood, &c., in the mountains of New England; fertile.

10. C. *decorticata*, Floerk. Th. squamulose; podetia slender, cylindrical, the submembranaceous epidermis separating into furfuraceous scales, pulverulent; scyphi narrowed or obsolete; apoth. fuscous. *Floerk.! Clad. p.* 10. *Fr. Lichenogr. p.* 226. — *β. symphycarpea*, Fr.; podetia somewhat simple; apoth. symphycarpeous. *Fr. l. c.* — *γ. (ramosa)*, Fr.; podetia branched, subulate, sterile. *Fr. l. c.*

On the earth, in mountainous districts. White Mountains; fertile. Distinguishable from similar decorticate, symphycarpeous states of C. pyxidata by its pulverulence.

** *Perviæ*, Fr. Podetia not passing into closed scyphi, but the axils

and apices dilated-infundibuliform, or simply perforate in the more slender, much-branched forms.

11. C. *cenotea*, Schær. Th. squamulose, dissected; podetia dichotomous-brachiate, membranaceous-corticate, at length finely glaucous-pruinose; axils and fertile apices dilated, infundibuliform, with incurved margins; 'apoth. sessile, from pale becoming fuscous.' *Fr.! Lichenogr.* (*sub C. brachiata*), *p.* 228. *C. cenotea, Schær. Spicil. p.* 35. *Floerk.! Clad. p.* 135. *Bæomyces dein Cenomyce, Ach.* — *α*; turgid; axils and apices as above. *Fr. l. c.* — *β. furcellata*, Fr.; slender, fruticulose; branches subulate, axils perforate. *Fr. l. c.*

On the earth, in mountainous districts. White Mountains; as yet infertile.

12. C. *parasitica*, Schær. Th. squamulose, narrowly erose-laciniate and granulate-pulverulent; podetia delicate, at length besprinkled with scales and granules, divided above into short, somewhat incrassated branches; apoth. minute (often symphycarpeous), fuscous. *Schær.! Spicil. p.* 37. *Lichen parasiticus, Hoffm. C. delicata, Floerk.! Clad. p.* 7. *C. squamosa, var. delicata, Fr.! Lichenogr. p.* 231.

Decaying logs, common in mountainous districts; New England. Pennsylvania, *Muhl.* (Cf. Fries, l. c.)

13. C. *squamosa*, Hoffm. Th. squamulose, dissected, often somewhat pulverulent; podetia branched, lacunose, at length decorticate, and exasperate with squamaceous granules; axils pervious, denticulate; apoth. cymose, fuscous. *Fr. Lichenogr. p.* 231. — *α. ventricosa*, Fr.; podetia ventricose; axils and apices dilated-infundibuliform. *Fr.! l. c. Cenomyce sparassa, Ach. Cladonia, Floerk.! Clad. p.* 129. — *β. attenuata*, Fr.; podetia more slender, attenuate, axils pervious, apices subulate. *Fr.! l. c.*

On the earth, decaying logs, and stones, most perfect and frequent in mountainous districts; New England.

14. C. *furcata*, Floerk. Th. squamulose, somewhat dissected; podetia dichotomous-fruticulose, cartilagineous-corticate, polished, greenish-fuscous; axils and fertile apices pervious; apoth. pedicellate, from pale becoming fuscous. *Fr. Lichenogr. p.* 229. *Floerk. Clad. p.* 141. — *α. crispata*, Fl.; turgid; axils and apices infundibuliform. *Floerk.! l. c. p.* 148. *Fr.! l. c.* — *β. cristata*, Fr.; somewhat turgid; obliquely dilated and fimbriate-cristate at the axils; the apices cristate-ramulose.

Fr. l. c. Dill. Musc. p. 544, & Icon, *t.* 82, *f.* 1. — *γ. racemosa*, Floerk.; podetia elongated, turgescent, ramose, and, as well as the axils, gaping; branches recurved or erect, fertile ones explanate. *Floerk.! l. c. p.* 152. *Fr.! l. c.* — *δ. subulata*, Floerk.; podetia elongated, more slender, with subpertuse axils; apices of the fertile ones cloven; branches erectish, or also recurved, or divergent. *Floerk.! l. c. p.* 143. *Fr. l. c.* — *ε. pungens*, Ach.; small, cæspitose, very much and intricately branched, fragile, pallescent or whitish-cinereous. *Fr. l. c. C. pungens, Floerk. l. c. p.* 156. *C. rangiformis, Hoffm.*

On the earth, common; most perfect in mountainous regions; New England to Ohio. New York, *Halsey*. Pennsylvania, *Muhl.* — *β.* Pennsylvania, *Dill.* — *ε.* Greenland, *Floerke.*

15. C. *rangiferina*, Hoffm. Th. crustaceous, evanescent; podetia fruticulose, trichotomously and very much branched, somewhat tomentose, cinerascent; axils subperforate; sterile apices nodding, fertile ones erect, cymose; apoth. fuscous. *Fr. Lichenogr. p.* 243. *Floerk.! Clad. p.* 160. — *β. sylvatica*, Floerk.; slender, smoother, pale-straw-colored. *Floerk. Clad. p.* 167. *Fr. l. c.* — *γ. alpestris*, Floerk.; softish, the branches and branchlets very densely thyrsoid-entangled. *Floerk. Clad. p.* 165. *Fr. l. c.*

On the earth, common everywhere, and fertile; New England. New York (*α*, *β*, and *γ*), *Halsey*. Pennsylvania, *Dill.* Northward to Canada, *Michaux;* Greenland, *Gieseke;* and elsewhere in Arctic America, *Rich.*, *R. Br.*

Series 3. *Ochroleucæ*, Fr. Podetia ochroleucous; at length fuscous-cerulescent at the base. Apothecia somewhat livid-flesh-colored, lutescent within.

16. C. *carneola*, Fr. Th. squamulose; podetia membranaceous-corticate, at length finely pulverulent, ochroleucous, becoming fuscous-cerulescent at the base, the scyphiferous ones turbinate; apoth. pale-flesh-colored fuscescent. *Fr. Lichenogr. p.* 233. — *α*; podetia turbinate, all scyphiferous, simple or proliferous. *Fr. l. c.* — *β*; podetia elongated-turbinate, with radiate, subulate prolifications. *Fr. l. c.* — *γ. cyanipes*, Fr.; podetia very long, cylindrical, simple, or the scyphi obliterated and passing into somewhat divaricate, sterilescent branches. *Fr. l. c.* Icon, *Laur. in Sturm's Fl. t.* 13.

On the earth; Arctic America. Greenland, *Fries.*

17. C. *Despreauxii*, Bory ms. Th. evanescent; podetia elongated, slender, cartilagineous-corticate, the epidermis separating below into bluish-white squamules, and becoming above finely granulate (not pulverulent), pale sulphureous, becoming bluish-fuscescent at the base; scyphi narrow, proliferous-radiate, or passing into and obliterated in sterilescent branchlets; apoth. minute, pale-flesh-colored fuscescent. *Cenomyce Despreauxii, Bory, fide schedul. in herb. Berol.*

On the earth in alpine districts. White Mountains. Newfoundland, *Bory!*

18. C. *amaurocræa*, Floerk. Th. crustaceous, evanescent; podetia elongated, slender, polished, somewhat curved-decumbent, pale-straw-colored; apices fuscous-black, those of the sterile podetia subulate, variously branched, of the scyphiferous ones irregularly proliferous-branched; scyphi narrow, oblique, margin dentate-radiate; apoth. pale-flesh-colored fuscescent. *Floerk.! Clad. p.* 119. *Cenomyce oxyceras, Ach. Syn.*

On the earth in alpine districts. White Mountains, very luxuriant and fertile. Greenland, *Floerke*, and elsewhere in Arctic America, *R.ch.*

19. C. *Botrytis*, Hoffm. Th. squamulose; podetia cylindrical, cartilagineous-corticate, verruculose, ochroleucous; somewhat divided into subfastigiate branches; apoth. pale-flesh-colored and pallescent. *Fr. Lichenogr. p.* 234.

On the earth, and decaying logs. New York, *Halsey.*

20. C. *uncialis*, Fr. Th. crustaceous, evanescent; podetia fruticulose, dichotomous, smooth, greenish-straw-colored; axils subperforate; sterile apices erect, blackish, fertile ones digitate-radiate; apoth. at first pale-flesh-colored, fuscescent. *Fr. Lichenogr. p.* 244. *Ach. Syn. p.* 276. *C. stellata, Schær.! Spicil.* 1, *p.* 42 (*excl.* δ). *Floerk.! Clad. p.* 171. — α. *humilior;* shorter, more slender, and smooth, somewhat attenuate, the axils often imperforate. *Fr. l. c. Cenomyce uncialis, Ach. Lichenogr. Lichen uncialis, Auct.* — β. *adunca*, Ach.; taller, somewhat turgid, incrassated above; branches short, stellate-patent, the fertile ones cymose; axils gaping. *Ach. l. c. p.* 277. *Fr. l. c.* (α.) *C. biuncialis, Hoffm. C. adunca, Ach. Lichenogr.* — γ. *turgescens*, Schær.; softish, turgid-incrassated, the branches subtruncate, fastigiate. *Schær. Spicil.* 1, *p.* 308. *Fr. l. c.*

On the earth: α, sands, and sterile pine woods (fertile?); — β, in

similar places, fertile; and abundant also in mountainous districts; — γ, alpine and subalpine regions; New England. New York, *Halsey.* Pennsylvania (α and β), *Muhl.* Canada (β), *Michaux.*

21. C. *Boryi*, Tuckerm. Th. (crustaceous) evanescent; podetia turgid, fruticulose, dichotomous, fastigiate-ramose, rugulose becoming reticulate-perforate, pale sulphureous and glaucescent; axils scyphiform, entire, at length cribrose-perforate; sterile apices scyphiform, cristate-dentate, entire becoming cribrose, with fuscous tips; fertile ones somewhat cymose-radiate; apoth. flesh-colored, at length dark-fuscous. *C. uncialis, var. reticulata, Russell, in Essex Jour. Nat. Hist. Tuckerm. Enum. Lich. N. Amer. p.* 53, *excl. syn.* — *β. lacunosa;* podetia incrassated, obtusish, lacunose-subperforate, glaucous; axils and apices scarcely scyphiform, sparingly subdentate. *Cenomyce lacunosa, Bory, fide sched. in herb. Berol.*

On the earth, near the sea, fertile; Hingham, Duxbury, *Mr. Russell!* and elsewhere on the coast of Massachusetts, *Dr. Porter! Mr. Oakes!* — β, alpine and montane districts, infertile; White Mountains. Monadnoc, *Russell!* Newfoundland, *Bory!* I have endeavoured to point out the features that seem to distinguish this remarkable Lichen from C. uncialis, but it is possible that the conclusion of its original indicator may be correct. The podetia become very turgid, and at length often explanate, measuring in one of my specimens eight lines in diameter at the base, and five where the branches begin. The Newfoundland specimen, and our alpine ones, belong to an apparently sterile, subalpine state of the Lichen.

Series 4. *Cocciferæ*, Fr. Podetia greenish, becoming fulvescent at the base. Apothecia scarlet.

* Podetia cartilagineous-corticate, never finely pulverulent.

22. C. *cornucopioides*, Fr. Th. squamulose; podetia cartilagineous-corticate, from glabrous becoming verrucose or granulate-subpulverulent, yellowish, at length cinereous-green; the scyphiferous ones elongated-turbinate, attenuate below; scyphi cyathiform, dilated; apoth. scarlet. *Fr. Lichenogr. p.* 236. *Lichen cornucopioides, L. Fl. Suec. Cenomyce coccifera, Ach. Cladonia, Hoffm. Floerk.! Clad. p.* 89. *Lichen cocciferus, L. part.* Icon, *Laur. in Sturm's Fl. tt.* 23, 24, 25.

On the earth. Very frequent in mountainous districts, but often infertile; New England. New York, *Torrey.* Pennsylvania, *Muhl.* North to the Saskatchawan, &c., *Rich.*, and Greenland, *Gieseke.*

23. C. *bellidiflora*, Schær. Th. of minute, dissected squamules; podetia cartilagineous-corticate, elongated, ventricose-cylindrical, glabrous, becoming at length densely clothed with dissected squamules, yellowish, at length cinereous-green; scyphi extremely narrow; apoth. (often conglomerate, or symphycarpeous), scarlet. *Fr. Lichenogr. p.* 237. *Schær. ! Spicil. p.* 21. *Floerk. ! Clad. p.* 95.

On the earth, in alpine districts; White Mountains. Greenland, *Floerke.*

24. C. *Hookeri*, Tuckerm. Th. of rather thick, large, ascendant squamules; podetia cartilagineous-corticate, elongated, cylindrical, glabrous, becoming at length squamulose, sulphur-yellow; scyphi cupulæform; apoth. scarlet.

On the earth; Newfoundland, *Herb. Hook. !* This beautiful species resembles C. deformis in some respects, but belongs to the present subdivision, and seems very distinct from every other scarlet-fruited Cladonia with which I am acquainted. I venture to inscribe it to the illustrious botanist who first proposed a complete survey of the cryptogamy of British America, and who has done more than any other to illustrate it.

25. C. *Floerkiana*, Fr. Th. squamulose; podetia cartilagineous-corticate, cylindrical, slender, glabrous, becoming at length granulate-verrucose or squamose-decorticate, greenish and pallescent, nigrescent at the base; scyphi passing into somewhat digitate, fastigiate branches; apoth. scarlet. *Fr. Lichenogr. p.* 238. *Floerk. Clad. p.* 99. *Lichen digitatus, E. Bot. t.* 2439. Icones, *Dill. Musc. t.* 15, *f.* 19, *c. Laur. in Sturm's Fl. t.* 14, *d.*

On the earth, decaying logs, dead wood, and rocks, common and fertile; New England.

** Epidermis of the podetia membranaceous, dissolving into a fine dust.

26. C. *macilenta*, Hoffm. Th. squamulose; podetia cylindrical, slender, membranaceous-corticate above, becoming hoary-pulverulent; scyphi narrow, tubæform with an erect margin, or obsolete; apoth. scarlet. *Fr. Lichenogr. p.* 241. — *α. filiformis*, Fr.; podetia very slender; scyphus narrow, entire, or obliterated by a symphycarpeous apothecium. *Fr. ! l. c. C. filiformis, Schær. ! Spicil. p.* 19. *Tuckerm. Lich. N. E. l. c. Cenomyce bacillaris, Ach. C. polydactyla, Floerk. !*

Clad. p. 108. — *β. clavata*, Fr.; podetia ventricose, subulate at the apices or branched, substerile. *Fr. l. c.*

On the earth, decaying logs, dead wood, and rocks; common in mountainous districts, and fertile; New England. Pennsylvania, *Muhl.* Ochrocarpous states of this species, in which the bright scarlet of the apothecia is changed to a pale yellow, occur in our mountains, but less frequently than similar forms of C. Floerkiana.

27. C. *digitata*, Hoffm. Th. squamulose; podetia cylindrical, becoming ochroleucous-pulverulent above; scyphi narrowed, with an incurved, entire margin, becoming at length ampliate, and the margin somewhat proliferous-palmate; apoth. scarlet. *Fr. Lichenogr. p.* 240. *Schær.! Spicil. p.* 22. *Floerk.! Clad. p.* 102. *Lichen digitatus, L.* Icon, *Laur. in Sturm's Fl. t.* 15, 16. — *α. platyphyllina;* lobules of the thallus dilated, somewhat entire; scyphi mostly entire. *Fr. l. c.* — *β. microphyllina;* squamules of the thallus rather small; scyphi mostly palmate-ramose. *Fr. l. c.*

Decaying trunks, and moist earth among mosses, in mountainous districts, fertile; New England.

28. C. *deformis*, Hoffm. Th. squamulose; podetia elongated, cylindrical or ventricose, becoming sulphureous-pulverulent above; scyphi somewhat narrow, becoming at length cupulæform and dilated, with an erect, crenate-dentate margin; apoth. scarlet. *Fr. Lichenogr. p.* 239. *Schær.! Spicil. p.* 23. *C. crenulata, Floerk.! Clad. p.* 105.

On the earth, common upon mountains, a conspicuous Lichen, fertile; New England. Northward to Arctic America, *Rich.* Greenland, *Floerke.*

29. C. *sulphurina*, Michx. (sub Scyphoph.). Podetia simple, at first very simply and slightly scyphiform, thick, submembranaceous, at length subclavate-elongated, smooth, the apices finally irregularly subdivided, and rimose-perforate, hoary-sulphureous; fertile scyphi small; apoth. confluent, black-fuscous. *Scyphophorus sulphurinus, Michx. Fl.* 2, *p.* 328. *Cenomyce, Ach. Lichenogr. p.* 557. *Ach. Syn. p.* 265.

On the earth, Canada, *Michaux! Fries.* This is the "Lichen cocciferus; major, Dill. t. 14, f. 6, M," of Michaux's herbarium, the specimens appearing to me, at the time I examined them, to resemble some states of C. deformis. Fries observes incidentally (Lichenogr. p. 237) upon Canada specimens ('specimina authentica Canadensia') of Michaux's Lichen, that the podetia do not become squamulose, that it has

infundibuliform and not true scyphi, and much of the habit of C. uncialis; thus distinguishing it from C. bellidiflora, to which Floerke referred it. It is probable that the "Bæomyces tubulosus, Richard. Canada," of Herb. Willd.! which also appeared to me to resemble C. deformis, belongs to Michaux's species, and in this case the thallus is squamulose, and the podetia are finely pulverulent above. It appears certain that the C. sulphurina of Fries is not the C. Hookeri of this Enumeration. The species is also common in North Carolina, according to Fries, who received his specimens from Schweinitz.

XIV. BÆOMYCES, Fr.

Apothecia from the first globose, immarginate, velate, at length empty and araneous within, the base closely surrounding a stipe. Thallus crustaceous, uniform, protruding fertile stipes, which are destitute of a cortical stratum.

The structure of Bæomyces roseus has been illustrated very minutely by Dr. Küttlinger (Allg. Bot. Zeit. 1845, pp. 577 – 584, & t. vi.).

B. *roseus*, Pers. Crust verrucose, glaucous; stipes short, cylindrical; apothecia subglobose, flesh-colored. *Fr. Lichenogr. p.* 246.

Sterile clay-soils, and sands; New England; and abundant also on the sterile surfaces of slides in the White Mountains. New York, *Torrey*. Pennsylvania, *Muhl.*

XV. BIATORA, Fr.

Apothecia margined at first by a waxy thalline exciple converted into a proper exciple, becoming at length hemispherical or globose, subimmarginate, solid, and cephaloid. Disk at length dilated, turgid, concealing the paler margin, placed upon a stratum oftener paler, never coal-black. Thallus horizontal, arising from a hypothallus, somewhat crustaceous, effigurate, or uniform. Podetia wanting, but the apothecia stipitate in a few species. The margin of the apothecia never originally black. *Fr.*

Sect. I. Thallus squamose, or lobed at the circumference.

* Apothecia sessile.

1. B. *decipiens*, Fr. Scales of the thallus discrete, somewhat peltate, angulate, dark-flesh-colored; beneath and at the circumference

white; apothecia marginal, adnate, somewhat immarginate, blackish, white within. *Fr. Lichenogr. p.* 252. *Lecidea, Ach. Syn. p.* 52.

On the earth, especially in alpine districts. Arctic America, *Rich.* Pennsylvania, *Muhl.*

2. B. *globifera*, Fr. Th. squamose, imbricate, greenish-chestnut, somewhat shining; scales reniform, rugose, lobate; apoth. elevated, globose, somewhat immarginate, from rufous becoming black, whitish within. *Fr. Lichenogr. p.* 255. *Lecidea, Ach. Syn. p.* 51. Icon, *Laur. in Sturm's Fl. t.* 26.

Clefts and depressions of rocks. North America, *Ach.* Pennsylvania, *Muhl.* New York, *Halsey.*

3. B. *rufo-nigra*, Tuckerm. Th. squamose, imbricate, from pale rufous becoming blackish; scales irregularly suborbiculate, ascending, crenate-lobate; apoth. adnate, plane, obtusely margined, atrorufous, at length convex, black. *Placodium sp. nov. Tuckerm. Lich. N. E. l. c.* 1838.

Rocks; near Boston. Scales of the thallus small, obscure to the naked eye.

4. B. *atro-rufa*, Fr. Th. crustaceous, smoothish, adnate, at first contiguous, becoming at length areolate, cinereous-fuscescent; black beneath; at the circumference foliaceous-lobate; apoth. applanate-adnate, rufous-fuscous, whitish within. *Fr. Lichenogr. p.* 255. *Lecidea, Ach. Lichenogr. p.* 200.

On the earth in alpine districts. , White Mountains.

** Apothecia stipitate, margin at length revolute.

5. B. *placophylla*, Fr. Th. subcrustaceous, orbicular, corrugated, glaucous-virescent, at the circumference foliaceous, lobes rounded, and crenate; white beneath; apoth. stipitate, pileiform, rufous-fuscous; stipes thick, compressed, longitudinally rugulose. *Fr. Lichenogr. p.* 257. *Bæomyces, Ach. Meth. p.* 323, & Icon, *t.* 7, *f.* 4. *Lich. Univ. p.* 574.

On sandy, sterile earth; slides, and banks of streams, in the White Mountains.

6. B. *Byssoides*, Fr. Th. crustaceous, effuse, granulose, greenish-glaucous, squamulose at the circumference; hypoth. fibrillose, white; apoth. substipitate, pileiform, from flesh-colored becoming fuscous;

stipes rather short, somewhat compressed, corticate with the ascending granules of the crust or naked, often subdivided at the apex. *Fr. Lichenogr. p.* 257. *Bæomyces rupestris, Ach. Lich. p.* 573. *B. rufus, Wahl. B. Byssoides, Schær.* — *α.* Fr.; granules of the crust subsquamaceous, crenulate (and deliquescent), greenish-glaucous. *Fr. l. c.* — *β. rupestris*, Fr.; cr. thin, smoothish, subcontiguous (or powdery); apoth. smaller. *Fr. l. c. Bæom. rupestris, Pers.* — *γ. lignatilis*, Fr.; cr. rugose, cinereous-glaucescent; apoth. subsessile, fuscous-black. *Fr. l. c. Bæom. lignorum, Pers.*

Common in mountainous districts: *α*, sterile sandy and clayey soils; slides, banks of streams, and road-sides, in the mountains of New England. — *β*, rocks in mountain forests, New England. New York, *Halsey.* — *γ*, decaying wood, in similar situations with the last, apothecia almost sessile. The three varieties occur often in close neighbourhood at the White Mountains. This species, Stereocaulon Fibula, and S. aciculare illustrate the connection of Stereocaulon with the sessile Biatoræ. The difference of structure, indicated by Fries as generically distinguishing Bæomyces roseus from this and the last species, referred to Bæomyces by Acharius, has been further illustrated by Dr. Küttlinger in Allg. Bot. Zeit. 1845, l. c.

SECT. II. Thallus effuse, uniform.

7. B. *icmadophila*, Fr. Crust tartareous, granulate, greenish-glaucous; hypothallus white; apothecia (large) softish, incarnate, exciple cupular, with a thin, evanescent margin. *Fr. Lichenogr. p.* 258. *Lecidea, Ach. Bæomyces, DC.*

Decaying wood in mountain forests, and on the earth; ascending to alpine districts; New England. New York, *Torrey.* Pennsylvania, *Muhl.* Arctic America, *Rich.* Apothecia sometimes a little stipitate in ours, as in the European Lichen.

8. B. *vernalis*, Fr. Cr. of minute, glaucescent granules, arising from a membranaceous, whitish hypothallus; apoth. at length subglobose, clustered, flesh-colored, and fulvous-ferrugineous. *Lecidea vernalis, Borr. in Hook. Br. Fl.* 2, *p.* 183. *L. luteola, Ach.*

Trunks in mountain forests, growing over mosses; New England. New York, *Halsey.* Arctic America, *Rich.*

9. B. *pineti*, Fr. Cr. very thin, granulose, greenish-glaucescent; apoth. (minute) sessile, whitish; disk becoming at length yellowish-

flesh-colored, finally falling out and the apothecia urceolate. *Lecidea*, *Ach. Syn. p.* 42. *Hook. Br. Fl. l. c.* *Biatora*, *Fr. Summ. Fl. Scand.*

Scales of fir-bark, and on the earth. Pennsylvania, *Muhl.*

10. B. *sanguineo-atra*, Fr. Cr. thin, membranaceous, effuse, whitish-cinerous, becoming granulose; apoth. sanguineous, with an obscure paler margin, at length black. *Fr. Summ. Fl. Scand.* *B. vernalis*, *β. sanguineo-atra*, *Fr. Lichenogr. p.* 263.

Trunks and rocks, growing over mosses, in mountainous districts; New England.

11. B. *carneola*, Fr. Cr. confused with the hypothallus, cartilagineous-membranaceous, glaucescent, at length granulate-pulverulent; apoth. sessile, concave, naked, from reddish-flesh-colored becoming fuscous, exciple cupular, with an elevated, at length evanescent, paler margin. *Fr. Lichenogr. p.* 264. *Lecidea*, *Ach.*

Trunks; New England. New York, *Halsey*. Apothecia somewhat larger in my specimens than in the European Lichen.

12. B. *spadicea*, Ach. (sub Lecid.). Cr. cartilagineous-membranaceous, granulate, glaucescent; apoth. thick, margin very finely rugulose, at length somewhat convex and excluding the margin, light-chestnut becoming blackish, within of the same color. *Lecidea spadicea*, *Ach. Syn. p.* 34.

Trunks; Pennsylvania, *Muhl.*, *Ach.* Southward. Fries considers this scarcely distinct from the last. (Lichenogr. p. 264.)

13. B. *cinnabarina*, Sommerf. Cr. confused with the hypothallus, cartilagineous, uneven, glaucous becoming whitish; apoth. appressed, cinnabar-red, naked, becoming at length convex, and immarginate. *Fr. Lichenogr. p.* 266. *Lecidea*, *Sommerf. Vet. Ac. Handl.* 1823 (*e Fr.*).

Trunks. Greenland, *Fries*. *Lecidea coccinea*, *Schwein. in Hals. Lich. N. Y. l. c.* 1824, which cannot, by the description, be distinguished from this, occurs in New York, *Halsey*, and appears to extend to N. Carolina! (*Mr. Curtis*).

14. B. *chlorantha*, Tuckerm. Cr. of discrete, subsquamaceous-verrucose granules, bright green, and white within (or deliquescent sorediiferous); apoth. somewhat elevated, becoming plane, and at length convex, with a thick, flexuous, paler margin; within white; disk nigrescent.

Bark of Pinus Strobus, and other trees; New England. Resem-

bling Lecidea enteroleuca, but with a different crust, and, I think, the apothecia of the present genus.

15. B. *decolorans*, Fr. Cr. tartareous, confused with the hypothallus, areolate-granulose, glaucescent; apoth. appressed, naked, from flesh-colored becoming fuscous and black, with a thin, elevated, paler margin; finally convex and irregular, and the margin disappearing. *Fr. Lichenogr. p.* 266. *Lecidea, dein Lecanora granulosa, Ach. Lecidea decolorans, Floerk. Ach. Syn.*

On the earth, and decaying wood, in mountainous regions; New England. Northward to Arctic America, *Rich.*

16. B. *anomala*, Fr. Cr. confused with the white hypothallus, at length granulose, white-cinerascent; apoth. becoming hemispherical-globose, somewhat hyaline-livid, at length fuscescent and black, margin very thin, evanescent. *Fr. Lichenogr. p.* 269. *Lecanóra commutata, Ach. Syn. p.* 149.

Trunks, dead wood, &c. New York, *Halsey*. An obscure species. Nomen omen. *Fr.*

17. B. *mixta*, Fr. Cr. cartilagineous, confused with the hypothallus, rugose-verrucose, milky-glaucescent; apoth. adnate, exciple annular, disk at first plane, pruinose, flesh-colored or livid, becoming at length turgid, fuscous, and black, and excluding the obtuse margin. *Fr.! Lichenogr. p.* 268. *Lecidea anomala, Ach. part. Tuckerm. Lich. N. E. l. c.*

Trunks, and dead wood. New England.

18. B. *porphyritis*, Tuckerm. Cr. subcartilagineous, smooth, chinky, at length rugose, glaucescent (and greenish-sorediiferous); white within; apoth. elevated on a white thalline stratum which constitutes an evanescent spurious margin, or sessile; disk at first somewhat plane, pruinose, with a thick, elevated margin, at length convex, and excluding the margin, fuscous-nigrescent.

Trunks, in the mountains of Massachusetts and New Hampshire. Near to B. mixta, but as that is one of the smallest, this is the largest Biatora that I am acquainted with. Several apothecia sometimes occupy the same thalline stratum, as in B. ochrophæa and B. aurantiaca. With age the apothecia become flexuous, and very large, a single exciple having sometimes a diameter of two lines.

19. B. *ochrophæa*, Tuckerm. Cr. subcartilagineous, thickish, gran-

ulate-verrucose and somewhat plicate, glaucescent; hypoth. pale; apoth. elevated-subpedicellate on a thalline stratum, which constitutes a thick, subcrenulate, at length evanescent spurious margin; disk plane, delicately pruinate, at length convex, and excluding its thin, elevated, proper margin, from pale flesh-colored becoming blackish-fuscous.

Trunks in the mountainous districts of Northern New England, common. Apothecia at first closed, and either sessile (when some states resemble Parmelia carneo-lutea, Turn.) or elevated on a protuberant thalline stratum, at length lacerate-dehiscent and becoming plane, with a thick, crenulate thalline margin, which disappears, leaving the marginate disk. It has often all the aspect of a Parmelia, not a little resembling P. rubra. Is the structure of the apothecia in the last-mentioned species, and in P. carneo-lutea, wholly diverse from the structure above described of the present?

20. B. *russula*, Tuckerm. Cr. subcartilagineous, rimose-areolate, and granulate, glaucescent (often greenish-serediiferous); apoth. elevated on a thalline stratum which constitutes a thick, mostly entire spurious margin, becoming convex, and excluding the obscure proper margin, fuscous-reddish. *Lecidea, Ach. Syn. p.* 40. *Lecanora, Feé, Crypt. Exot. p.* 116.

Trunks of cedars on the coast of New England. Pennsylvania, *Muhl.* Extending to the tropics.

21. B. *rivulosa*, Fr. Cr. tartareous, mouse-colored and paler, covering a fuscous-black hypothallus, which often decussates the crust; apoth. produced from the crust, from pale-fuscous becoming blackish, whitish within, with a thin margin. *Fr. Lichenogr. p.* 271. *Lecidea, Ach. Lecanora falsaria, Ach.*

Rocks, especially in mountainous districts; New England. Pennsylvania, *Muhl.* Northward to Arctic America, *Rich.*

22. B. *exigua*, Chaub. Cr. of minute, confluent granules, smooth, cartilagineous, cinereous-greenish; decussated by lines of the black hypothallus; apoth. submarginate, from pale-yellowish becoming fuscous. *Fr. Lichenogr. p.* 278. *Lecidea varians, Ach. Syn. p.* 38. *Tuckerm. Lich. N. E. l. c. L. versicolor, Schwein. in Hals. Lich. N. Y. l. c.?*

Smooth bark; New England. New York, *Halsey*? Pennsylvania, *Muhl.*

23. B. *quernea*, Fr. Cr. deliquescent, granulose-farinose, fuscescent-ochroleucous; hypoth. black; apoth. immersed, convex, brown, at length immarginate. *Fr. Lichenogr. p.* 279. *Lecidea, Ach.*

Trunks; New England.

24. B. *lucida*, Fr. Cr. granulate, greenish-yellow, at length deliquescent and ochroleucous; hypoth. white; apoth. (minute), convex, pale yellow, often excluding the paler margin. *Fr. Lichenogr. p.* 279. *Lecidea, Ach.*

Stones and decaying wood. Arctic America, *Rich.*

25. B. *aurantiaca*, Fr. Cr. cartilagineous, uneven, somewhat granulate, lutescent; innate in a black hypothallus; apoth. somewhat elevated on a thalline stratum which constitutes a crenulate, evanescent, spurious margin, disk dark-orange (and fuscescent), with a thin proper margin. *Parmelia, Fr.! Lichenogr. p.* 165. *Lecidea, Ach. Borr. in Hook. Br. Fl.* 2, *p.* 186. *Lecanora salicina, Ach.*

Trunks, dead wood, and rocks; New England. New York, *Halsey.* Pennsylvania, *Muhl.* Arctic America, *Rich.*

26. B. *fusco-lutea*, Hook. (sub Lecid.). Cr. thin, effuse, smooth, somewhat granulose, whitish; apoth. somewhat elevated, plane, yellowish, at length rufous-fuscous, pruinose, with a thin margin. *Lecidea, Hook. in Rich. l. c. Lichen fusco-luteus, Dicks. E. Bot. t.* 1007.

Upon mosses; Arctic America, *Rich.* Fries suspects this to be a state of B. ferruginea. It does not seem to be the Lecidea fusco-lutea, *α*, of Ach. Syn.

XVI. LECIDEA, Ach., Fr.

Apothecia margined at first by a very black, carbonaceous, proper exciple, becoming scutelliform or hemispherical, solid. Disk at first punctiform-impressed, always open, oftener horny, and placed upon a carbonaceous stratum. Thallus horizontal, arising from a hypothallus, somewhat crustaceous, effigurate, or uniform. Apothecia very black from the first, the margin never, and the disk rarely, otherwise colored. *Fr.*

Sect. I. Thallus effigurate at the circumference, or wholly rugose-plicate.

1. L. *candida*, Ach. Crust rugose-plicate, candicant, becoming at length white-farinose, lobed at the circumference; hypothallus black;

apothecia appressed, obtusely marginate, glaucous-pruinose, white within. *Fr. Lichenogr. p.* 285.

On the earth upon mosses; Arctic America, *Rich.*

2. L. *vesicularis*, Ach. Cr. bullate-plicate, somewhat caulescent, from greenish becoming glaucous, radiculose at the base; apoth. free, peltate, obtusely marginate, at first pruinose, finally convex, naked; white within. *Fr. Lichenogr. p.* 286.

On the earth in alpine districts; Arctic America, *Rich.*

3. L. *Wahlenbergii*, Ach. Cr. suborbicular, gyrose-plicate, round-lobed at the circumference, from green becoming bright-yellow; hypoth. black; 'apoth. arising between the areolæ, obsoletely marginate, naked, black within.' *Fr.! Lichenogr. p.* 291. Icon, *Laur. in Sturm's Fl. t.* 28.

Moist sides and crevices of rocks in alpine districts. On the Great Haystack, New Hampshire, infertile. Arctic America, *Rich.*

4. L. *flavo-virescens*, Fr. Cr. determinate, areolate-appressed, plicate, lobulate at the circumference, from greenish becoming yellow; apoth. adnate, with a thin margin, becoming at length convex, and excluding the margin, black within. *Fr. Lichenogr. p.* 291. *L. scabrosa, Ach. Meth.*

On the earth in mountainous districts, often in company with Biatora Byssoides; White Mountains. According to Borrer (in Hook. Br. Fl. 2, p. 178), L. citrinella, Ach., is the true Lichen flavo-virescens of Dickson, and the present species should bear the name given it by Acharius. Compare Fries, l. c.

Sect. II. Thallus effuse, uniform.

Subsect. I. Areolatæ, Fr. Crust innate, originally areolate or becoming so. Hypothallus black.

* *Saxicolæ.*

5. L. *albo-cærulescens*, Fr. Cr. at first contiguous, from bluish becoming whitish; apoth. produced from the crust, margin of the annular exciple thin, disk waxy, black, cerulescent-pruinose, white within. *Fr. Lichenogr. p.* 295. *L. pruinosa, Ach. Tuckerm. Lich. N. E. l. c.* — *β. immersa*, Fr.; cr. very thin, whitish, disappearing; apoth. small, oftener immersed in the rock. *Fr. l. c. L. immersa, Ach.*

Rocks and stones, especially granite and mica-slate; New England.

New York, *Halsey*. Pennsylvania, *Muhl.* — β, limestone ; New York, *Torrey*. Pennsylvania, *Muhl.*

6. L. *contigua*, Fr. Cr. at first contiguous, glaucous-white ; apoth. produced from the crust ; disk thick, horny, very black, at first glaucous-pruinose, with a thick, discrete, plano-cupular, obtusely marginate, carbonaceous exciple. *Fr. Lichenogr. p.* 298.

Rocks and stones (granite), and often tinged ochraceous by the oxide of iron, in the mountains of New England.

7. L. *variegata*, Fr. Cr. at length areolate, glaucescent ; the black, somewhat fimbriate hypothallus here and there prominent ; apoth. produced from the crust, depressed, at first and often persistently glaucous-pruinose, black within ; disk from urceolate becoming explanate, and dilated, with a persistent, at first thin, coarctate, at length obtusish margin. *Fr. Lichenogr. p.* 303.

Maritime granite rocks ; Arctic America, *Fries*.

8. L. *lapicida*, Ach. Cr. at length areolate-verrucose, from glaucous becoming cinereous-white ; apoth. superficial, produced from the cortical layer, sessile, not pruinose, horny and cinerascent-black within, with an even, naked disk, and a thin, at length flexuous margin (or, the margin disappearing, finally confluent and irregular). *Fr. Lichenogr. p.* 306.

Rocks and stones (granite), in mountainous districts ; New England. New York, *Halsey*. Pennsylvania, *Muhl.* Arctic America, *Rich.*

9. L. *atro-alba*, Ach. Cr. somewhat areolate (the areolæ commonly discrete, verrucæform), opake, fuscous, and grayish-white ; apoth. produced from the hypothallus, (small,) the obtuse margin scarcely discrete from the naked, at length somewhat umbonate disk. *Fr. Lichenogr. p.* 310.

Rocks and stones (granite) ; New England. New York, *Halsey*. The crust variable, and often nearly obsolete.

10. L. *panæola*, Ach., Fr. Areolæ of the crust verrucose, gray, variegated with rufescent tubercles ; apoth. produced from the hypothallus ; exciple cupular, with a persistent, obtuse margin ; disk always plane, very black, cæsious-pruinose, white within. *Fr. Lichenogr. p.* 314. — β. *obscurata*, Fr. ; areolæ thinner, applanate, somewhat contiguous, fuscescent. *Fr. l. c.* *L. obscurata*, *Schær.* ! *Spicil. p.* 130. *Tuckerm. Lich. N. E. l. c.*

Rocks and stones in mountainous districts; White Mountains.

11. L. *fusco-atra*, Fr. Areolæ of the crust cartilagineous, applanate, olivaceous-fuscescent and fuscous, angulate, smooth and somewhat polished (or becoming dull and pallescent); apoth. produced from the hypothallus, appressed; disk plane, at first cinereous-pruinose, at length naked, with a thin, somewhat acute, at length flexuous margin; but the margin disappearing with age, and the apothecia often finally heaped and conglomerate. *Fr. Lichenogr. p.* 316. *L. fumosa, Ach. L. athrocarpa, Ach.*

Rocks and stones in mountainous districts. New England. New York, *Halsey*. Arctic America, *Rich.*

12. L. *confluens*, Schær. Cr. rimose-areolate, opake, cinerascent-smoke-colored; apoth. produced from the crust, appressed, somewhat contiguous (often confluent); margin not elevated, obtusish; disk always naked, very black, within cinerascent. *Schær.! Spicil. p.* 144. *Fr. Lichenogr. p.* 318.

Rocks and stones in mountainous and alpine districts; New England. New York, *Halsey*. Arctic America, *Rich.*, *Hook.*

13. L. *Morio*, Schær. Areolæ of the crust verrucose, shining, of a yellowish-copper-color, radiant at the circumference; apoth. produced from the thick, determinate, black hypothallus, minute, depressed, plane, becoming gyrose-plicate with age; margin thin; disk always naked, black within. *Fr. Lichenogr. p.* 319. *Schær. Spicil. p.* 133.— *β. coracina*, Schær.; crust (from the predominance of the hypothallus) cinerascent-black. *Schær.! l. c. Fr. l. c.*

Rocks in alpine and subalpine districts; White Mountains.

14. L. *geographica*, Schær. Cr. of somewhat confluent, bright-yellow areolæ; apoth. produced from the hypothallus, blackish within; margin of the cupular exciple thin; disk naked. *Fr. Lichenogr. p.* 326. *Schær.! Spicil. p.* 124.— *α. atro-virens*, Schær.; areolæ verrucæform, scattered in the hypothallus; apoth. immixed. *Fr. l. c. Schær. l. c.*— *β. contigua*, Schær.; areolæ applanate, confluent in a somewhat contiguous, chinky crust; apoth. immersed. *Fr. l. c. Schær. l. c.* — *γ. alpicola*, Schær.; areolæ applanate, coalescent and large, somewhat rugose, interruptedly covering the hypothallus; apoth. innate. *Fr. l. c. Schær. l. c.*

Rocks and stones (granite and mica-slate), in alpine and subalpine districts, and at lower elevations, in the mountains of New England. Newfoundland, *Pylaie*. Northward to Arctic America, *Rich.*

** *Corticolæ.*

15. L. *premnea*, Ach. Cr. glaucescent, softish, deliquescing and leprous, obliterating the hypothallus; apoth. elevated; exciple cupular, with an obtuse margin; disk horny, very opake, and obsoletely black-pruinose, white within. *Fr. ! Lichenogr. p.* 329. *Patellaria leucoplaca, DC. Fl. Fr.* 2, *p.* 347 (*e Fr.*).

Trunks and rails; New England. New York, *Halsey*.

16. L. *parasema*, Fr. Cr. somewhat leprous, glaucescent, becoming at length verrucose-areolate, somewhat limited by the black hypothallus; apoth. sessile, opake; exciple cupular, with a thin margin; disk horny, naked, very black. *Fr. Lichenogr. p.* 330. *L. punctata, Floerk. ! D. Lich. n.* 81. *Schær. ! Helv. n.* 197 – 199.

Trunks, and degenerant on dead wood; New England. New York, *Halsey*. Pennsylvania, *Muhl.* Arctic America, *Rich.* A most common and widely diffused species, but all black apothecia with a thin or without any crust are not to be referred to it. *Fr.* Compare Borr. in Hook. Br. Fl. 2, p. 176.

17. L. *enteroleuca*, Fr. Cr. at first contiguous, glaucescent, deliquescing and leprous, somewhat limited by the black hypothallus; apoth. adnate; exciple annular, with a thin margin; disk somewhat waxy (often hyaline or cerulescent), whitish within. *Fr. ! Lichenogr. p.* 331. — *β. olivacea*, Fr.; cr. yellowish-virescent; apoth. often irregular and rugose, ærugineous-black. *Fr. l. c. L. elæochroma, Ach. Syn.*

Trunks; New England. New York, *Halsey*. Pennsylvania, *Muhl.*

Subsect. II. Granulosæ, Fr. Crust at length becoming somewhat granulose. Hypothallus white.

18. L. *sanguinaria*, Ach. Granules confluent in a tartareous crust, glaucescent; hypoth. white; apoth. superficial, naked, at length convex; exciple annular; disk placed upon a blood-red stratum. *Fr. Lichenogr. p.* 335.

Trunks, decaying wood, and stones, in mountainous and subalpine districts; New England. New York, *Halsey*.

19. L. *albo-atra*, Schær. Cr. areolate-verrucose, glaucous-white, often somewhat tartareous and mealy; hypoth. white; apoth. (small) innate-protuberant, at first coronate with the crust, cæsious-pruinose, coal-black within, with a thin, evanescent margin. *Fr. Lichenogr. p.*

336. *Schær. Spicil. p.* 140: *Borr. in Hook. Br. Fl.* 2, *p.* 180. *L. corticola, Ach. Syn.*

Trunks on the coast of New England. New York, *Halsey*. Pennsylvania, *Muhl.*

20. L. *dolosa*, Wahl. Cr. somewhat verrucose, greenish-glaucous, oftener leprous and white; apoth. (minute) depressed; exciple cupular, with a very thin margin; disk very black, nearly naked, often punctate-scabrous, cinereous-blackish within. *Fr. Lichenogr. p.* 337. *L. pinicola, Sommerf. Suppl. Fl. Lapp. p.* 153. *L. pinicola, Borr. in Hook. Br. Fl.* 2, *p.* 176? *Tuckerm. Lich. N. E. l. c.*
Scaly bark of old pines; New England.

21. L. *melancheima*, Tuckerm. Cr. cartilagineous, areolate-verrucose, becoming somewhat lobulate, glaucous-white, confused with the hypothallus; apoth. appressed, somewhat plane, disk equalling the very thin margin, at length convex, scarcely excluding the margin, very black, polished, and shining.
Trunks; and very common on rails on the coast of Massachusetts (Ipswich, *Mr. Oakes*, Lynn, Hingham, &c.), and occurring on dead wood at the White Mountains. Disk sometimes a little pallescent, but the margin always very black.

22. L. *sabuletorum*, Fr. Cr. cartilagineous, at first contiguous, becoming rimose-areolate, granulate and somewhat lobulate, cinerascent or fuscous, confused with the hypothallus; apoth. produced from the crust, horny; exciple annular, with an evanescent margin; disk naked, often fuscescent. *Fr. Lichenogr. p.* 339. *Lichen s. Lecidea muscorum, Auct. quorund.*
On the earth, decaying wood and mosses, stones, and trees, ascending to alpine districts; New England. New York, *Torrey*. Pennsylvania, *Muhl.* Arctic America, *Rich.*

23. L. *arctica*, Sommerf. Granules of the crust cartilagineous, at first discrete, papillæform, persistent, fuscescent-cinereous; apoth. immixed, somewhat immarginate, cæsious-pruinose, horny and cinerascent within. *Fr. Lichenogr. p.* 342. *Sommerf. Suppl. Fl. Lapp. p.* 156.
Upon mosses in alpine districts; White Mountains.

24. L. *milliaria*, Fr. Granules of the crust at first discrete, fuscous, and cinereous-white, often deliquescent and leprous; apoth. produced among the granules, globose, somewhat immarginate, naked; exciple

cupular; disk at length rugulose and tuberculate, blackish within. *Fr. Lichenogr. p.* 342. — *α. terrestris*, Fr. — *β. saxatilis*, Fr. — *γ. lignaria*, Fr.! *Lichen dubius, E. Bot. t.* 2347 (*e Fr.*). *L. dubia, Turn. & Borr. in Hook. Br. Fl.* 2, *p.* 176. *Tuckerm. Lich. N. E. l. c.*

On old rails (*γ*), common; New England.

Tribe III. GRAPHIDACEÆ, Fr.

XVII. UMBILICARIA, Hoffm.

Apothecia superficial; an originally closed thalline exciple converted into a carbonaceous proper exciple, becoming more or less open, of various form. Disk horny, ascigerous, at length chinky, or gyrose-plicate, with an incurved margin. Thallus horizontal, cartilagineous, foliaceous, somewhat monophyllous, affixed by a central point.

This most natural genus can, perhaps, still be retained in the place given it in the *Lichenographia Europæa*, though I have, in pursuance of Fries's suggestion (l. c. p. 347), confirmed by all the observations that I have been able to make, preferred to alter the generic character, and make it indicate more fully the relations of the group. It appears to me as analogous to Biatora as to Sticta; and as the former genus is considered to indicate a Lecideaceous type, irrespective of its approximations to Parmelia, so Umbilicaria may perhaps be taken as typically representative of a peculiar (perhaps properly lirellæform, or Graphidaceous) type, irrespective of the approach which some of the species make to the characters of Parmeliaceæ.

Sect. I. PATELLATÆ. Apothecia orbiculate-patellæform; disk at length chinky, plicate, or proliferous-papillate.

1. U. *mammulata*, Ach. (sub Gyroph.). Thallus membranaceous, smooth, irregularly round-lobed and somewhat crenate, fuscous-nigrescent; on the under side very black, papillose-granulate, and fibrillose; apothecia elevated, orbiculate; margin rather thick; disk plane, chinky, becoming at length convex, and proliferous-papillate. *Gyrophora mammulata, Ach. Syn. p.* 67. *G. mamillata, Muhl. Catal. p.* 105.

Rocks. Pennsylvania, *Muhl.* (North Carolina, *Mr. Curtis!*) Very distinct from the next.

2. U. *Pennsylvanica*, Hoffm. Th. coriaceous-membranaceous, papulose, dark-fuscous; on the under side papillose-granulate and nigrescent; apoth. elevated, orbiculate; margin rather thin; disk plane, but becoming at length convex, chinky, and plicate. *Hoffm. Pl. Lich.* 3, *p.* 5, *& t.* 69, *f.* 1, 2. *Lecidea, Ach. Meth. p.* 86. *Gyrophora, Ach. Lichenogr. p.* 227. *Ach. Syn. p.* 67. *Hook. in Rich. App. Frankl. Narr. p.* 759. *U. pustulata, Michx.! Fl.* 2, *p.* 322, *non Hoffm.*

Rocks. Mountains of Pennsylvania, *Muhl.* New York, *Halsey.* New England, common, and fertile. Canada, *Michaux!*

3. U. *pustulata*, Hoffm. Th. coriaceous, papulose, cinerascent; on the under side smooth, and reticulate-lacunose; apoth. appressed, orbiculate-patellæform, somewhat simple; margin obtuse. *Fr. Lichenogr. p.* 351. *Hook.! Br. Fl.* 2, *p.* 219. *Gyrophora, Ach.* — *β. papulosa*, Tuckerm.; apoth. at length subpedicellate, irregularly proliferous-papillate, excluding the margin. *Gyrophora papulosa, Ach. Lich. Univ. p.* 226. *Ach. Syn. p.* 67. *U. lævis, Pers.* (*ex Ach.*). *Gyroph. bullata, Willd. herb.!*

Rocks. *α*, New York, *Halsey.* — *β*, Nova Scotia, 'used for dyeing reds and browns'; Gov. Wentworth, 1795, *Herb. Smith!* Newfoundland, *Bory* in herb. Kunth! New York, *Torrey.* Pennsylvania, *Muhl.!* New England, common and fertile, and ascending to alpine districts, where it is often smaller, thicker, and glaucous-pruinose. *β* does not seem to afford any constant characters to distinguish it from the European Lichen but the luxuriant development of the apothecia. In the var. papillata, Hampe! a Cape of Good Hope Lichen, the apothecia are papillate, and perhaps also by a proliferous growth of the patellæform apothecium; but this variety, though in other respects resembling ours, is distinct from it. The small, fruticulose tufts almost characterizing this species in Europe, which I have also observed in the Swedish U. vellea, are generally wanting in the American plant, which is almost always normal and fertile.

4. U. *anthracina* (Schær.), Fr. Th. coriaceous, not papulose, black; on the under side smooth and black-pruinose; apoth. elevated, orbiculate-patellæform, simple; margin tumid, disk somewhat plane and even. *Fr. Summ. Fl. Scand. U. atro-pruinosa, Schær. in Ser. Mus.* (*cit. Fr.*). *Fr. Lichenogr. p.* 351. *Lecidea, Schær.! Spicil.* 1, *p.* 104. *Lichen anthracinus, Wulf.* — *α*; th. smooth and even above. *Schær. l. c. Fr. l. c.* — *β. tessellata*, Schær.; th. above finely rimose-areolate or punc-

tate-verrucose, rugose at the central point. *Schær. l. c. Fr. l. c.* — *γ. reticuluta*, Schær.; th. reticulate-rugose above. *Schær. l. c. Fr. l. c.*

Rocks in alpine districts. *α*, Newfoundland, *Bory* in herb. Willd.! — *γ*, Bear Lake, and elsewhere in Arctic America, *Hook.!* (Parry's Sec. and Third Voy.).

5. U. *polyphylla*, Hoffm. Th. coriaceous-cartilagineous, smooth, corrugated, fuscous-black; on the under side very black and glabrous; 'apoth. sessile, at first patellæform, marginate, becoming at length convex, and concentrically plicate.' *Fr. Lichenogr. p.* 352. *Gyrophora, Hook.! Br. Fl.* 2, *p.* 217. *Lichen, L. Gyrophora glabra, Ach.* — *β. deusta*, Fr.; th. thinner, furfuraceous-flocculose; somewhat lacunose and paler on the under side. *Fr. l. c. Umbilicaria deusta, Hoffm. Gyrophora, Ach. Lichen, L.*

Rocks on mountains; *α*, alpine; — *β*, descending. White Mountains, infertile. Northward to Newfoundland, *Pylaie*, and Greenland, *Herb. Banks!*

6. U. *proboscidea*, DC., Stenh. Th. submembranaceous, reticulate-rugose, olivaceous-fuliginous; on the under side pale and fibrillose; apoth. somewhat elevated, orbiculate-patellæform, becoming at length convex, very gyrose, or proliferous-papillate, somewhat excluding the margin. *Fr. Lichenogr. p.* 354. *Gyrophora, Ach. Hook.! Br. Fl.* 2, *p.* 219. — *β. tornata*, Ach.; th. indurated, complicated, plicate-rugose; obsoletely fibrillose beneath. *Ach. Syn. p.* 65. *Hook. in Rich. l. c. p.* 758, & Icon, *t.* 30, *f.* 4. — *γ. arctica*, Ach.; th. incrassated, rugose; glabrous beneath. *Ach. l. c. Fr. l. c.*

Alpine and subalpine rocks. White Mountains; and Chin of Mansfield in the Green Mountains, fertile. Northward to Arctic America, *Rich.*

7. U. *cylindrica*, Ach. (sub Gyroph.). Th. subcoriaceous, rigid, smoothish, livid, cinereous-pruinose, ciliated with elongated, rigid, ramose, black fibres (or naked); on the under side somewhat pale-ochroleucous; apoth. pedicellate, orbiculate-patellæform, plane, becoming at length hemispherical, gyrose-plicate, scarcely excluding the margin. *Gyrophora cylindrica, Ach. Hook.! Br. Fl.* 2, *p.* 218. *Lichen, L. U. proboscidea, β, Fr. Lichenogr. p.* 356.

Alpine rocks. A single specimen from Bear Lake, *Herb. Hook.!*

is perhaps referable to this species, which has escaped notice, but probably occurs within our limits.

8. U. *hirsuta*, Ach. (sub Gyroph.). Th. coriaceous, softish, pulverulent, cinerascent and white; on the under side from pale-fuscous becoming blackish, very hirsute with large, softish, at first pale, branched fibres (at length subfibrillose-scabrous and black); apoth. marginal, appressed, becoming patellæform, and at length convex, and subglobose, gyrose-plicate, with a thin margin. *Gyrophora hirsuta, Ach.! Syn. p.* 69. *U. vellea, γ. hirsuta, Fr. Lichenogr. p.* 358.—*β. depressa;* th. at length rigid; apoth. somewhat impressed, plane, with a thick margin. *U. vellea, β. depressa, Fr. l. c. U. deprèssa, β. spadochroa, Schær.! Tuckerm. Lich. N. E. l. c.* (*sub Gyroph. spadochroa*).

Rocks. Common in mountainous, and ascending to alpine districts, New England, fertile. Northward to Arctic America, *R. Br.* The New England Lichen does not appear to differ from those of Sweden and Switzerland, unless, perhaps, in attaining to a larger size, and, like the foreign ones, is near the U. vellea of Sweden, which differs in its tumid-marginate, papillate apothecia. Of the last species I have not seen American specimens, unless, with Schærer, and in accordance also with the earlier view of Fries, we consider the present species as a variety of it.

9. U. *Dillenii*, Tuckerm. Th. coriaceous, rather rigid, smooth, from glaucous-fuscescent becoming dark-fuscous; on the under side black, and closely hirsute with short, black, crowded fibres (or lacerate, and papillose-scabrous); apoth. convex, at first orbiculate and concentrically plicate, becoming at length lirellate, with a thin (canaliculate) margin. *Lichenoides coriaceum latissimo folio, &c., Dill. Musc. p.* 545, *& t.* 82, *f.* 5. *U. vellea, Michx.! Fl.* 2, *p.* 323, *& Auct. Amer.*

Rocks. Paiqualian Mountain, New Jersey, *J. Bartram* (Dill.). Canada, *Michaux!* Newfoundland, *Herb. Montagne!* Pennsylvania! *Muhl.* New York, *Torrey.* Very common in New England, and fertile. The apothecia are often abortive (very small, and forming sometimes a continuous black crust); but in a single specimen from the White Mountains they are perfect, and agree with the minute description in Michaux, whose Lichen was certainly the same with that of Dillenius. The species is widely diffused in North America, and preserves its peculiar features from Newfoundland to the Alleghanies of Pennsylvania; contrasting in this respect with the more limited and

northern U. hirsuta. It was considered certainly distinct, in 1841, by Montagne. Linnæus cites the figure of Dillenius under his Lichen velleus, and his description includes also U. hirsuta, the differences in the apothecia being disregarded; but the specimen that I saw in the Linnæan herbarium was the L. vellea of Sweden, which I have collected abundantly in that country, and which seems to me very distinct from the present.

Sect. II. LIRELLATÆ. Apothecia somewhat lirellæform, becoming at length angulate-patellate, or finally crowded together in a hemispherical, subimmarginate, lirellate tubercle.

10. U. *hyperborea*, Hoffm. Th. coriaceous-membranaceous, papulose-rugose, dark-olivaceous-fuscous, and blackish; on the under side lacunose, smooth, and fuscous-nigrescent; apoth. appressed, originally somewhat lirellæform, at length angular, substellate-multiform, plicate and papillate, with an apparent margin. *Fr. Lichenogr. p.* 353. *Gyrophora, Ach. Floerk.! Berl. Mag. cit. Fr.*

Alpine and subalpine rocks (and perhaps a flocculose state, *β. deusta*, Enum. Lich. N. Amer., descending), White Mountains; Chin of Mansfield and other of the Green Mountains, fertile. Arctic America, *Rich.* Rocky Mountains, *Herb. Hook.!* In separating this section of the genus from the other, I have endeavoured to indicate the features of difference that seem, at the first view, to distinguish the lirellate from the patellate apothecia; but I am uncertain how far the proposed characters are constant. The ternary division, incidentally proposed by Fries (Lichenogr. p. 349), suggested the present; but my present acquaintance with the species has not enabled me to adopt the former entire.

11. U. *erosa*, Hoffm. Th. cartilagineous, rigid, cribrose-reticulate, at length rugulose, dark-fuscous-nigrescent; on the under side papillose-granulate, subfibrillose-lacerate in somewhat anastomosing ridges, dark-fuscous and cinerascent; apoth. originally somewhat lirellæform, at length patellate, becoming convex and gyrose-plicate, and finally substellate-multiform, and immarginate. *Fr. Lichenogr. p.* 354. *Schær.! Spicil. p.* 93.

Alpine rocks. White Mountains, fertile. Newfoundland, *Pylaie.* Northward to Arctic America, *R. Br., Hook.* Northwest Coast, *Menzies!*

12. U. *Muhlenbergii*, Ach. (sub Gyroph.). Th. coriaceous-cartilagineous, somewhat lacunose-reticulate, olivaceous-fuscous; on the under side papillose-granulate, lacerate in anastomosing ridges, fuscous-cinerascent; apoth. somewhat sunk, originally lirellæform, at length composite, stellate-multiform, crowded finally into a convex, immarginate tubercle. *Gyrophora, Ach. Lichenogr. p.* 227. *Syn. p.* 67. *Hook. in Rich. l. c. p.* 758. — *β. alpina*, Tuckerm.; smaller, thickened, and complicated. *Lich. N. E. l. c.*

Rocks. Lancaster, Pennsylvania, *Muhl.!* New York, *Halsey*. New England, common and luxuriant on the coast. Northward to Newfoundland, *Bory* in herb. Kunth! and Arctic America, *Rich.* — *β*, alpine rocks, White Mountains. The descriptions by Sprengel (Syst. IV. pp. 262, 263) of this species and of U. Pennsylvanica seem to have been transposed.

13. U. *angulata*, Tuckerm. Th. coriaceous-cartilagineous, very rigid, smooth, and somewhat polished, becoming dark-fuscous and nigrescent; on the under side very black, papillose-granulate, lacerate at the centre, with paler fibres; apoth. somewhat impressed, originally sublirellæform, becoming angulate-patellate, lirellate, and at length convex, with an obtuse margin.

Rocks. (California, *Menzies!*) Northwest Coast, *Herb. Hook.!* Perhaps nearest to U. Dillenii, the apothecia at length resembling those of that species.

XVIII. OPEGRAPHA, Humboldt.

Apothecia somewhat lirellæform, elongated, margined by a free, carbonaceous, proper exciple. Disk canaliculate, at first closed by the inflexed-connivent margin, becoming open, indurated, and horny. Thallus crustaceous.

The Graphideæ proper, excluding Umbilicaria, constitute a peculiar subtribe, which attains to its full development only in the tropics; passing there into several genera not found elsewhere. Eschweiler (Systema, & Lich. Brasil. in Mart. Fl. Bras.), Chevallier (Histoire des Graphidées), and Feé (Essai sur les Cryptogames des Écorces Exotiques Officinales) have illustrated these genera, which are probably represented in our Southern States, where also several remarkable species of the present genus, inhabiting the South of Europe and extending north as far as the warmer parts of England (Borrer), may be expected to occur.

SECT. I. Apothecia superficial, destitute of a thalline margin.

1. O. *varia*, Pers., Fr. Crust somewhat leprous, indeterminate (rarely innate in the matrix); apothecia superficial, tumid; margins of the entire exciple at length distant, becoming thin, or disappearing; disk somewhat plane, at first subpruinose, blackish within. *Fr. Lichenogr. p.* 364. *O. cymbiformis, Schær.! Spicil.* 1, *p.* 50. — *α. pulicaris*, Fr.; apoth. rather elliptical; disk a little concave, margin inflexed. *Fr. l. c. O. vulvella, Ach.* — *β. notha*, Fr.; apoth. rounded; disk turgescent, and often obliterating the margin. *Fr. l. c. Opegrapha, Ach. Graphis curvula, Ehrh. Tuckerm. Lich. N. E. l. c.* — *γ. signata*, Fr.; apoth. elongated; disk broad, plane, margin evanescent. *Fr.! l. c. Opegrapha, Ach. Lichen hebraicus, Hoffm. O. cymbiformis, var. hebraica, Schær.! Spicil. p.* 330, *part.* — *δ. diaphora*, Fr.; apoth. elongated, both ways rather attenuated; margin somewhat persistent. *Fr. l. c. Opegrapha, Ach.*

Thick bark of oaks and other trees, and degenerant on dead bark and wood, and stones; New England. New York (*α* and *β*), *Halsey.* Pennsylvania (*α* and *β*), *Muhl.*

2. O. *atra*, Pers., Duf. Cr. innate in the matrix; apoth. emergent-superficial, slender, shining, acute; margin of the somewhat entire exciple thin; disk linear, canaliculate, naked, horny within. *Fr. Lichenogr. p.* 366. — *α. stenocarpa*, Fr.; apoth. very long, semicylindrical, flexuous; discrete, or reticulate-anastomosing, or maculæform and irregular. *Fr. l. c. Schær.! Spicil. p.* 48. *O. stenocarpa, denigrata, vulgata, & epipasta, α, Ach.* — *β. abbreviata*, Fr.; apoth. abbreviated, irregular, often radiately disposed. *Fr. l. c. O. depressa, & O. epipasta, γ, δ, Ach.* — *γ. macularis*, Fr.; apoth. dilated into somewhat radiate, immarginate maculæ, and confluent. *Fr.! l. c. Arthonia astroidea, & A. Swartziana, Ach.* — *δ. siderella*, Fr.; cr. fuscescent; apoth. acute, opake, somewhat innate and here and there erumpent. *Fr. l. c. Opegrapha, Ach. O. rufescens, α. rubella, Schær.! Spicil. p.* 50 (*e Fr.*).

Smooth bark of trees; New England. New York (*α* and *γ*), *Halsey.* Arctic America (O. epipasta, *β*), *Rich.*

3. O. *herpetica*, Ach., Fr. Cr. innate in the matrix, at length erumpent, and verruculose; apoth. emergent, elliptical or obtusely lanceolate, opake (somewhat ocellate or marginate by the white thalline verrucæ); margins of the entire exciple thin; disk canaliculate, naked,

horny within, becoming tumid, and covering the margin. *Fr.! Lichenogr. p.* 368.

Bark of oaks, and other trees, New England.

4. O. *abnormis*, Ach. Cr. thin, softish, white; apoth. immersed, very slender, short or very long, flexuous, confluent, rugose-crisped, opake, black; disk and margin somewhat confluent and indistinct. *Ach. Syn. p.* 74.

Hard bark of trees; Pennsylvania, *Muhl.*, *Ach.* A mostly tropical species growing on Cascarilla, and other bark.

Sect. II. Graphis. Apothecia erumpent, coronate for the most part with a thalline margin.

5. O. *scripta*, Ach., Schær. Cr. innate in the matrix, becoming at length exposed, uneven, and pulverulent; apoth. immersed, erumpent, with a raised accessory thalline margin; the proper margin tenuescent, smooth; the disk linear, at first cæsious-pruinose. *Fr. Lichenogr. p.* 370. *Schær.! Spicil. p.* 46. — *α. limitata*, Schær.; apoth. emergent, scattered irregularly, various. *Fr. l. c. Schær. l. c.* — *β. recta*, Schær.; apoth. immersed, straight, parallel, disk somewhat dilated. *Fr. l. c. Schær. l. c. O. recta, Humb. O. Cerasi & betuligna, Ach.* — *γ. serpentina*, Schær.; apoth. immersed, flexuous, very long, the thalline margin tumid, evanescent. *Fr. l. c. Schær. l. c. O. serpentina, Ach.*

Bark of trees; New England. New York (*α*, *β*, and *γ*), *Halsey.* Pennsylvania (*α* and *β*), *Muhl.*

6. O. *polymorpha.* Cr. somewhat pulverulent, whitish-cinerascent or very white; apoth. somewhat rounded or oblong, irregular, without apparent proper margin, from plane becoming tumid and elevated-punctate, angulose, repand, or somewhat stellate-ramulose, cæsious-pruinose, with a more or less conspicuous thalline margin. *Arthonia polymorpha, Ach. Syn. p.* 7. *Feé Crypt. Exot. p.* 53. *Eschw. Lich. Bras. l. c. p.* 111. *O. Cascarillæ, Floerk.! herb.* (*fide ips.*).

North America (Pennsylvania ?), *Muhl.* A common Lichen of Cascarilla bark, which Eschweiler (l. c.) has illustrated at length. The arrangement of Muhlenberg's catalogue leaves it probable that he considered it to occur within our limits.

7. O. *inusta*, Ach. (sub Graph.). Cr. membranaceous, somewhat rugulose, pale-virescent, decussated by black lines; apoth. minute, immersed, rather short, straight, simple or somewhat stellate-ramose, ob-

tuse, plano-concave, naked; the proper margin very thin, entire, concrete, with a thicker, elevated, thalline margin. *Graphis inusta*, *Ach. Syn. p.* 85.

Bark of Prinos verticillata, Canada, *Kalm.* (Ach.). In this variable genus, long observation is essential to any correct settlement of the species. The present appears to be wholly unknown here.

XIX. LECANACTIS, Eschw.

Apothecia immersed, rounded-irregular and lirellæform, always open, the cupular, carbonaceous, proper exciple connate with the thallus, which constitutes sometimes an accessory margin. Disk horny, somewhat plane, never connivent, veiled at first by the pruinose thallus, and bordered by the erect margin of the exciple. Thallus crustaceous.

L. *impolita*, Fr. Cr. tartareous, contiguous, chinky, glaucescent; apoth. immersed, dilated, maculæform, obscurely fuscous, glaucous-pruinose. *Fr. Summ. Fl. Scand. Arthonia, Borr. in E. Bot. Suppl. t.* 2692. *Parmelia, Fr. Lichenogr. p.* 183. *Lichen, Ehrh. Arthonia pruinosa, Ach.*

Trunks. Pennsylvania, *Muhl.*

Tribe IV. CALICIACEÆ, Fr.

XX. TRACHYLIA, Fr.

Apothecia sessile, discrete from the thallus, orbiculate. Disk somewhat compact, ascigerous, margined by the innate, carbonaceous, proper exciple, or the exciple obsolete. Asci oblong. Thallus crustaceous.

This genus, for which I am not able to furnish a complete character, is distinguished from the other genera of the tribe by the sporidia being contained in *asci*. Several of the species have also a peculiar habit, quite different from that of the true Calicia.

1. T. *tigillaris*, Fr. Crust areolate-verrucose, bright greenish-yellow; apothecia innate; the disk originally naked, black, equalling the tumid margin. *Calicium, Turn. & Borr. Lich. Brit. p.* 132. *Fr. Lichenogr. p.* 400. *Trachylia, Fr. Summ. Fl. Scand.*

Old rails and pales, and also on trunks. New England. New York, *Halsey.* Arctic America, *Rich.*

2. T. *stigonella*, Fr. Parasitical; exciple cupular, innate, black; the disk plane, black-pulverulent, equalling the thin, erect, black margin. *Calicium, Ach. Syn. Fr. Lichenogr. p.* 401. *Trachylia, Fr. Summ. Fl. Scand.*

(Crust of Pertusaria pertusa, var. coccodes; Fr.) Pennsylvania, *Muhl.* New York, *Torrey.*

XXI. CALICIUM, Pers., Fr.

Apothecia crateriform; a carbonaceous proper exciple margining a compact or powdery disk, composed of coacervate, naked sporidia. Thallus crustaceous.

Eschweiler's (Lich. Bras. l. c. p. 61) reference of the Calicia to Fungi seems, so far as I can venture an opinion on his observations, hardly satisfactory. The crustaceous thallus, though often, from various causes, deficient, exists normally in every species, except the parasitical and doubtful C. turbinatum; and the structure of the exciple connects the genus, together with the related Trachylia and Coniocybe, closely with Lecideaceæ, *quasi*, to use Fries's expression, *Lecidinarum degeneratio præcipitata.*

SECT. I. Apothecia stipitate.

* *Glaucescentia*, Fr. Exciple more or less whitish-cinereous-pruinose.

1. C. *viride*, Pers. Crust granulose, yellowish-green; stipes somewhat elongated, black; apothecia turbinate-lentiform, whitish-cinereous beneath; the disk plane. *Fr. Lichenogr. p.* 386.

Decaying wood in mountain forests; New England.

2. C. *lenticulare*, Ach. Cr. somewhat tartareous, rugose-granulate, grayish-white; stipes straight, thick, rigid, black; apoth. lentiform, whitish-cinereous beneath; the disk plano-convex. *Fr. Lichenogr. p.* 386. *C. clavellum, Turn. & Borr. Lich. Brit. p.* 138. *C. claviculare, Ach. part.* ICON, *E. Bot. t.* 1465.

Decaying wood, common in mountain forests; New England. New York (C. claviculare), *Halsey.* Arctic America (C. clavic.), *Rich.*

3. C. *curtum*, Turn. & Borr. Cr. filmy, whitish; stipes short, thick, firm, very black; apoth. turbinate-cylindrical, with a coarctate, whitish margin; the disk becoming at length protruded-prominent. *Turn. &*

Borr. Lich. Brit. p. 148. *Fr.! Lichenogr. p.* 387. Icon, *E. Bot. t.* 2503.

Decaying wood in the New Hampshire mountains. The protruded "disk often as long as the capitulum itself, and in the latter case giving the pilidium a miniature resemblance to a painter's brush." Lich. Brit.

4. C. *subtile*, Pers., Fr. Cr. filmy, leprous, white-glaucescent; stipes filiform, flaccid, black; apoth. lentiform-globose, naked, black; the margin at length reflected. *Fr.! Lichenogr. p.* 388. *C. debile, Turn. & Borr. Lich. Brit. p.* 151. Icon, *E. Bot. t.* 2462.

Decaying wood. Dead trees from which the bark has fallen in mountain forests; New England. Arctic America, *Rich.* Apothecia at first white-pruinose. Fr.

5. C. *trichiale*, Ach. Cr. of pale, squamulose, crenate granules; stipes commonly slender, elongated; apoth. turbinate, and, at length, from the swelling of the yellowish-brown disk, subglobose, white-cinereous beneath. *Fr.! Lichenogr. p.* 389. *Schær.! Spicil. p.* 5.

Rough bark of trees, as of hemlock; and on decaying wood; New England.

** *Fuscescentia*, Fr. Apothecia more or less ferrugineous.

6. C. *phæomelanum*, Tuckerm. Cr. of scattered, dissected squamules, green (and fuscescent); apoth. subsessile, ferrugineous-fuscous, at length black; the powdery, black disk at length surpassing the tumid, smooth margin.

Fir-bark in the New Hampshire mountains, common. I should most readily compare this with Trachylia tympanella, Fr., from which it differs in its slightly stipitate apothecia, &c. It is very unlike any European Calicium that I am acquainted with, but I think must be referable to the genus.

7. C. *hyperellum*, Wahl. Cr. somewhat tartareous, granulose, greenish-yellow; stipes elongated, thick, firm, dull brownish-black; apoth. lentiform, ferrugineous beneath; disk brownish-black. *Fr.! Lichenogr. p.* 389. *Turn. & Borr. Lich. Brit. p.* 140. Icon, *E. Bot. t.* 1832.

Decaying wood in the mountains of New England.

8. C. *trachelinum*, Ach. Cr. filmy, somewhat smooth, grayish; stipes elongated, slender, firm, ferrugineous-fuscous, becoming at

length black; apoth. turbinate-lentiform, rufous-ferrugineous beneath, at length, together with the disk, blackish. *Fr.! Lichenogr. p.* 390. *C. sphærocephalum, Turn. & Borr. Lich. Brit. p.* 153.

Decaying wood, and on trunks; New England. New York, *Halsey.* The stipes sometimes branched in this, as in C. subtile, and other species.

9. C. *melanophæum*, Ach., Fr. Cr. granulate-conglomerate, milk-white; stipes rather short, black; apoth. turbinate-globose, black and shining beneath, as is also the inflexed margin; disk pulverulent, ferrugineous-brown and nigrescent. *Fr.! Lichenogr. p.* 391. *Sommerf. Lapp. p.* 179.

Decaying wood in the New Hampshire mountains. The crust deficient in my specimens, but the apothecia appear to me like those of the Swedish Lichen. Sommerfelt remarks that he has gathered it but rarely, and is uncertain whether it is any thing else than a variety of the last, to which Fries also originally referred it.

10. C. *brunneolum*, Fr. Cr. very thin, smooth, whitish; stipes elongated, very slender, often branched, black; apoth. (small) turbinate-globose, dark-yellowish-ferrugineous; the disk of the same color, obliterating the margin of the exciple. *Fr.! Lichenogr. p.* 393. *C. parietinum, Schær.! Spicil. p.* 4.

Decaying wood in the mountainous districts of New England.

*** *Flavo-virescentia*, Fr. Apothecia yellowish-pruinose.

11. C. *chrysocephalum* (Turn.), Ach. Cr. granulate-conglomerate, bright greenish-yellow; stipes slender, often elongated, black, with often a greenish tinge; apoth. turbinate-lentiform, yellow-pruinose; the disk light-brown. *Turn. & Borr. Lich. Brit. p.* 143. *E. Bot. t.* 2301. *Fr.! Lichenogr. p.* 393.

Rough bark of hemlock and other trees, and on decaying wood; New England.

12. C. *phæocephalum*, Turn. & Borr. Cr. of discrete, crowded, at length squamulose and crenate, fuscescent granules; stipes slender, blackish-fuscous; apoth. turbinate-lentiform, greenish-yellow-pruinose; disk dark-fuscous. *Turn. & Borr. Lich. Brit. p.* 145. *Fr. Lichenogr. p.* 394. — *β*; cr. less perfect. *Fr.! l. c. C. roscidum, β. Schær.! Tuckerm. Enum. Lich. N. Amer. p.* 55. Icon, *E. Bot. t.* 1540.

Decaying wood (*β*), Arctic America, *Rich.* (Herb. Hook.!).

SECT. II. Apothecia sessile; without crust; parasitical.

13. C. *turbinatum*, Pers. Parasitical; exciple from globose becoming turbinate, sessile, free, shining-black, the disk impressed, with a thickish, inflexed margin. *Fr. Lichenogr. p.* 402. *C. sessile*, *DC. Turn. & Borr. Lich. Brit. p.* 128. ICON, *E. Bot. t.* 2520.

On the crust, and in the verrucæ of Pertusaria pertusa, Ach. New England. New York, *Torrey*. Pennsylvania, *Muhl.*

XXII. CONIOCYBE, Fr.

Apothecia stipitate, spherical, suberose, without margin, bursting at the apex and becoming at length entirely pulverulent, and concealing the proper exciple. Thallus crustaceous.

C. *nigricans*, Fr. Crust very thin, leprous, white; stipes naked, from whitish becoming black; apothecia globose, naked, black. *Fr. Lichenogr. p.* 384.

Rough bark of hemlock and rock-maple; New England. It is with hesitation that I refer our plant to the European species, though it appears to agree with a specimen from Flotow. The genus is at once distinguishable from the other genera of the tribe, and several other species, as C. *furfuracea*, with yellow-pulverulent apothecia, and C. *pallida*, with pale, white-pruinose apothecia, not improbably occur with us.

DIV. II. ANGIOCARPI, Schrad., Fr.

Tribe I. SPHÆROPHORACEÆ, Fr.

XXIII. SPHÆROPHORON, Pers.

Apothecia terminal, spherical, the thalline exciple at first closed, becoming at length lacerate-dehiscent. Nucleus globose, within cottony-cartilagineous, without powdery with naked, black sporidia. Thallus vertical, fruticulose, crustaceous-cartilagineous without, solid within.

1. S. *compressum*, Ach. Thallus fruticulose, whitish, irregularly branched, compressed, fibrillose-ramulose; apothecia globose-depressed,

at length disciform, with a reflexed margin. *Fr. Lichenogr. p.* 404. *Turn. & Borr. Lich. Brit. p.* 115. Icon, *E. Bot. t.* 114.

Rocks and on the earth in alpine districts. Canada, fertile, *Herb. Hook.!* Arctic America! *Rich.*

2. S. *globiferum* (L.), DC. Th. fruticulose, somewhat terete, with erectish, fibrillose-ramulose branches, chestnut; apoth. globose, with an inflexed margin. *DC. Fl. Fr. Lichen globiferus, L. S. Coralloides, Pers. Fr. Lichenogr. p.* 405. *Turn. & Borr. Lich. Brit. p.* 110 (*excl. β*). Icon, *E. Bot. t.* 115.

On the earth in alpine and subalpine districts; and descending, northward. White Mountains, fertile. Eastport, Maine, *Russell!* Newfoundland, *Pylaie.* Arctic America, *Hook.!*

3. S. *fragile*, Pers. Th. densely cæspitose, fruticulose, dichotomously branched, somewhat cinereous; branches terete, fastigiate, naked; apoth. turbinate-globose, with an inflexed margin. *Fr. Lichenogr. p.* 405. *Schær.! Spicil. p.* 7. Icon, *E. Bot. t.* 2474.

Alpine rocks. White Mountains, fertile. Northward to Arctic America, *Hook.* Rarely somewhat compressed.

Tribe II. ENDOCARPACEÆ, Fr.

XXIV. ENDOCARPON, Hedw.

Apothecia included in the thallus, globose; a membranaceous, thin, pale thalline exciple inclosing a gelatinous, colored, deliquescent nucleus; ostioles somewhat prominent. Thallus horizontal, cartilagineous-foliaceous, subpeltate.

1. E. *miniatum*, Ach. Thallus cartilagineous-coriaceous, rigid, pale-yellowish-fulvescent, becoming cinerascent and glaucous-pruinose; on the under side naked, at length somewhat rugose, fulvescent, at length black; ostioles somewhat prominent, fuscous-nigrescent. *Fr. Lichenogr. p.* 408. — *β. complicatum*, Schær.; cæspitose-polyphyllous; lobes ascendant, imbricate and complicate, cinereous; on the under side dark-fuscous. *Schær.! Spicil. p.* 59. *Fr. l. c.*

Rocks. New York, *Halsey.* Pennsylvania, *Muhl.* Arctic America, *Rich.* — *β*, near water, New England. New York, *Halsey.* Fries,

as well as Sprengel, refers E. glaucum, Ach. (North America, Ach.), to the variety α of the present species. I have not found this variety, but the next species is near to it.

2. E. *Muhlenbergii*, Ach. Th. cartilagineous-coriaceous, thick, from greenish-glaucous becoming fuscescent, very finely rugose and somewhat chinky; on the under side fuscous-black; ostioles convex. *Ach. Syn. p.* 101.

Rocks. North America, *Ach.* West Point, New York, *Russell!* (Cf. Ach. Syn. pp. 101, 103.)

3. E. *fluviatile*, DC. Th. cartilagineous-membranaceous, flaccid, lobed, green, becoming fuscescent when dry; lobes rounded, somewhat auriculate-lobulate, on the under side naked, reticulate-rugulose, pale-fuscous, becoming black; ostioles somewhat prominent, black. *Fr.! Lichenogr. p.* 409. *E. miniatum, γ. aquaticum, Schær.! Spicil. p.* 60. *E. Weberi, Ach.* — *β. fulvo-fuscum,* Tuckerm.; th. thick, subcoriaceous, submonophyllous, with auriculate-lobulate, somewhat inflexed margins, fuscous-fulvescent; on the under side reticulate-rugose, dark-fulvous-fuscous becoming black; ostioles scarcely prominent, dark-reddish nigrescent.

Rocks (granite), suffused with water; New England. New York, *Halsey.* Newfoundland, *Pylaie.* —*β*, alpine. Lake of the Clouds, White Mountains, at an elevation of five thousand feet. Fries remarks, in comparing the present species with E. miniatum, α, that monophyllous specimens of the former are always minute; but in *β* these occur nearly as large as average specimens of the latter. The very brief indication given by Persoon (Act. Wetterav.) of his E. Americanum answers to our variety.

4. E. *pusillum*, Hedw. Th. cartilagineous, squamulose-foliaceous, smooth, brownish-olivaceous, pale on the under side, arising from a black, fibrillose hypothallus; ostioles black, somewhat prominent, pertuse. *Fr. Lichenogr. p.* 411. *E. Hedwigii, Ach., & E. lachneum & squamulosum, Ach.* (*e Fr.*).

On the earth, and rocks, especially of the more recent formations. Pennsylvania, *Muhl.* New York, *Halsey.* Apparently wanting in the granite region of New England.

5. E. *lætevirens*, Turn. Th. thin, membranaceous, irregularly orbicular, somewhat concave, round-lobed, grass-green, margins very entire,

inflexed, the under side white at the edges. *E. viride, Ach. Verrucaria lætevirens, Borr. in E. Bot. Suppl. t.* 2658.

On the earth in alpine districts. White Mountains. Arctic America, *Rich.* The apothecia are unknown, and the plant is a very doubtful member of the present genus. Fries regards it a metamorphosis of the squamules of Cladonia.

XXV. SAGEDIA, Ach., Fr.

Apothecia included in the thallus, globose; nucleus gelatinous, deliquescent, and, as well as the membranaceous, thin exciple, becoming at length blackish; ostioles discrete, attenuated into a thin neck, and dilated at the apices, pertuse. Thallus horizontal, subcrustaceous.

S. *cinerea*, Fr. Crust cinereous, at length pruinose, somewhat foliaceous at the circumference; on the under side spongy, black; ostioles superficial, spheroidal. *Fr. Lichenogr. p.* 413. *Endocarpon, Pers. E. tephroides, α & β, Ach. Syn.*

(On the earth. Fr.) New York (rocks), *Halsey.* We have perhaps a Sagedia, on rocks, in New England.

XXVI. PERTUSARIA, DC.

Apothecia verrucæform, formed from the thallus, including (1 — 00) naked, waxy-gelatinous, colored nuclei. Thallus crustaceous, often passing into soredia and isidia.

1. P. *pertusa*, Ach. (sub Porina). Crust cartilagineous, glaucous-white; apothecia depressed-hemispherical, irregular; ostioles depressed, discrete, the perfect ones black-papillate. *Fr. Lichenogr. p.* 420. *Porina pertusa, Ach. Lichen pertusus, L. Pertusaria communis, DC.* — * *sorediifera;* crust sterile, sorediiferous. *Fr. l. c. Variolaria sp. Ach.* — ** *coccodes;* crust isidioid, papillose-ramulose. *Fr. l. c. Isidium coccodes, Ach.* — *β. areolata*, Fr.; crust thicker, rimose-areolate, verrucose, often sterile and sorediiferous. *Fr. l. c. Variolaria Flotowiana, Floerk.!* — *γ. leucostoma*, Fr.; apothecia with white ostioles, the black papillæ deficient. *Fr. l. c. Porina leucostoma, Ach.* — *δ. leioplaca*, Fr.; crust very smooth; apothecia imperfect, chinky-dehiscent. *Fr. l. c. Porina leioplaca, Ach.*

Trunks and dead wood; — *β*, stones; New England. New York (*α*, *γ*, and *δ*), *Halsey.* Pennsylvania (*α* and *δ*), *Muhl.*

2. P. *faginea.* Cr. tartareous-cartilagineous, cinereous-white, the circumference zonate, often thin, polished, and somewhat bluish; apoth. hemispherical, bursting into mealy soredia. *Lichen fagineus, L. & Auct.* (*e Fr.*). *Variolaria multipuncta, Turn. in Linn. Trans.* 9, *p.* 137, *t.* 10, *f.* 1. *V. faginea, Floerk.!* *P. sorediata, Fr.* — *β. orbiculata;* apoth. lax, explanate; the nuclei expanded into a submembranaceous, denudate, flesh-colored disk, which at length falls out, leaving the sorediiform verrucæ. *P. communis, β. sorediata, c. orbiculata, Fr. Lichenogr. p.* 422. *Variolaria faginea, communis, & corallina, Auct. var.*

Trunks, dead wood, rocks, and stones; New England and westward. New York, *Torrey.* Pennsylvania, *Muhl.* Arctic America, *Rich.* The Variolariæ have been illustrated most largely by Turner and Borrer, in the Lichenographia Britannica, and by the first-mentioned author in the Linnæan Transactions. That they are sorediiferous states of various crustaceous Lichens has been shown at great length by Meyer, Wallroth, and Fries, and this view is confirmed by the observations of Eschweiler and of Schærer. To the present species, and the last, most of our common Variolariæ are to be referred.

3. P. *papillata,* Ach. (sub Porina). Cr. smooth, chinky, whitish; apoth. convex, hemispherical; ostiole solitary, elevated, papillæform, with a rufescent pore. *Ach. Syn. p.* 111.

Trunks. New England. Pennsylvania, *Muhl.*

4. P. *globularis,* Ach. (sub Porina). Cr. of very numerous, subglobose, and ramulose, glaucescent granules; apoth. (infrequent) globose, smooth, with a solitary, impressed, punctiform, black ostiole. *Ach. Syn. p.* 112.

Upon mosses, Pennsylvania, *Muhl., Ach.*

5. P. *hymenia.* Cr. cartilagineous, pale-sulphureous or grayish, bordered by a black line; apoth. hemispherical-depressed, with a solitary, depressed ostiole, or more often dehiscent, marginate, and somewhat scutelliform, the discoid centre black-dotted. *Turn. & Borr. Lich. Brit. p.* 185, *sub Thelotr. Lichen hymenius, Ach. Prodr. P. Wulfenii, DC. Fr. Lichenogr. p.* 424. *Porina fallax, Ach. Syn.*

Trunks. New England. New York, *Halsey.* Pennsylvania, *Muhl.*

Tribe III. VERRUCARIACEÆ, Fr.

XXVII. CONOTRÉMA, Tuckerm.

Perithecia mostly solitary, horny, black, at first pertuse, becoming at length open, with a coarctate, inflexed margin, including a depressed nucleus, which is elevated at the centre into a somewhat marginate disk. Thallus crustaceous.

C. *urceolatum*, Tuckerm. Crust thin, smooth, rugose-rimose, glaucous-white, bordered by a black line; perithecia scattered, at first covered by the crust, finally superficial, conoidal, white-pruinose. *Lecidea urceolata, Ach. Lichenogr. p.* 671. *Ach. Syn. p.* 27. *Pyrenula enteroleuca, Spreng. in Hals. Lich. N. Y. l. c. Thelotrema enteroleuca, Schwein. in Hals. l. c. Verrucaria enteroleuca, Spreng. Syst.* 4, *p.* 243. *Tuckerm. Lich. N. E. l. c.* Icon, *Hals. l. c. t.* 1, *f.* 1.

Trunks. North America, *Swartz.* (ex Ach.). Pennsylvania, *Muhl.* in herb. Willd.! New York, *Halsey.* New England, very common. Probably the Lecanora urceolata of Muhl. Catal., but the above-cited specimen in the herbarium of Willdenow is without name. The Lichen appears to me an aberrant form of the present tribe. Thelotrema? atratum, Feé Crypt. Exot. t. 13, f. 4, seems to be distinguished from Thelotrema precisely as the present genus (passing over the other essential differences) is, by its black proper exciple, but the structure of the nucleus in the former plant removes it from ours.

XXVIII. VERRUCARIA, Pers.

Perithecia hemispherical-globose, solitary, horny, black, closed, with a simple or papillæform ostiole; becoming sometimes at length subscutelliform, or rarely inclosed in a thalline verruca. Nucleus gelatinous, hyaline, deliquescent. Thallus crustaceous.

* *Saxicolæ.* Crust somewhat tartareous.

1. V. *rupestris*, Schrad. Crust tartareous-compact, contiguous, whitish; perithecia (small) entire, globose, somewhat sunk, umbonate with the naked ostiole, at length collapsing and scutelliform; nucleus hyaline. *Fr. Lichenogr. p.* 436. *Hook. Br. Fl.* 2, *p.* 152. *V. Schraderi, Ach.* Icon, *E. Bot. t.* 1711, *f.* 2.

Rocks and stones (limestone). Pennsylvania, *Muhl.*

2. V. *elæochroa*, Tuckerm. Cr. applanate, rimose-areolate, olivaceous; perith. with a wide base, globose, emerging and conical at the apex, becoming at length depressed and umbilicate.

Rocks (limestone), Ohio, *Mr. Lea!* Apparently related to V. elæina, Borr. (E. Bot. Suppl. t. 2623, f. 2), and V. olivacea, Fr. (Lichenogr. p. 438), but very different from V. olivacea, Pers. (Borr. l. c. t. 2596, f. 1), which is a bark-Lichen.

3. V. *nigrescens*, Pers. Cr. somewhat gelatinous-tartareous, chinky, fuscous-nigrescent, within white; perith. entire, globose, covered by the crust and verrucose-prominent, subpapillate; nucleus whitish. *Fr. Lichenogr. p.* 438.

Rocks and stones (limestone), New England. New York, *Halsey.*

4. V. *umbrina*, Wahl. Cr. verrucose-granulate, or smoothish, from fuscescent at length dark-brown; perith. entire, globose, somewhat prominent above the crust, papillate. *Fr. Lichenogr. p.* 441.

Rocks and stones (granite), near water; New England. We have doubtless other saxicoline species, but they occur often in imperfect states, and are easily overlooked. I have an alpine Verrucaria, with large perithecia, from the White Mountains, but the crust is deficient.

** *Corticolæ.* Crust innate in the matrix, often deficient.

5. V. *nitida*, Schrad. Cr. innate in the matrix, smooth, greenish, olivaceous, or fuscous; perith. entire, covered, becoming at length somewhat prominent, persistent, ostioles subpapillate; nucleus fluxile. *Fr. Lichenogr. p.* 443. *Borr. in E. Bot. Suppl. t.* 2607, *f.* 1.

Trunks; the hue varying with the different epidermis of the matrix; New England. Pennsylvania, *Muhl.* V. composita, Schwein. in Hals. Lich. N. Y. l. c. p. 9, has apothecia clustered, forming dark spots, but I have not been able to find in my specimens, which agree apparently with the description, any constant characters to separate it from the present.

6. V. *alba*, Schrad. Cr. innate in the matrix, becoming at length denudate, white; perith. subglobose, entire, denudate, persistent, immersed at the base, ostiole papillate, or pertuse. *Fr. Lichenogr. p.* 444. — *β*; cartilagineous, smoothish; perith. smaller. *Fr. l. c. V. glabrata, Ach.*

Trunks. New England. Perithecia prominent.

7. V. *gemmata*, Ach. Cr. innate in the matrix, effuse, smoothish,

white-hoary; perith. hemispherical, dimidiate (not immersed at the base), persistent; nucleus whitish. *Fr. Lichenogr. p.* 444.

Trunks. New England. New York, *Halsey*.

8. V. *epidermidis*, Fr. Cr. innate in the matrix or obsolete; perith. dimidiate, the base patent, innate-superficial, at length collapsing, and, together with the nucleus, applanate-depressed. *Fr. Lichenogr. p.* 447. — α; perith. larger, orbiculate. *Fr. l. c. V. analepta, Ach.* — β; perith. larger, elliptical. *Fr. l. c. V. Cerasi & epidermidis, Ach.* — γ; perith. small, punctiform (with the habit of the next species). *Fr. l. c. V. stigmatella, Ach. part.*

Trunks, mostly on smooth bark; New England, and westward. New York (α and β), *Halsey*. Arctic America, *Rich.*

9. V. *punctiformis*, Pers. Cr. innate in the matrix or obsolete; perith. innate-superficial, semiglobose, subdimidiate, the base inflexed; nucleus globose. *Fr. Lichenogr. p.* 447. *V. stigmatella, Ach. part.*

Trunks on smooth bark; New England. New York, *Torrey*. Pennsylvania, *Muhl.* Arctic America, *Rich.*

10. V. *pulla*, Ach. Cr. smoothish, blackish-fuscous; perith. minute, hemispherical, glabrous, subpapillate, black within. *Ach. Syn. p.* 88.

Bark of Dirca palustris, *Ach.*, who compares it with V. carpinea, which is referred to the last species by Fries.

Tribe IV. LIMBORIACEÆ, Fr.

XXIX. PYRENOTHEA, Fr.

Perithecia round, carbonaceous, closed, pertuse at length with a simple ostiole, and protruding the somewhat gelatinous, bursting nucleus, finally dehiscent, explanate, and empty. (A disciferous state occurs in a single species.) Thallus crustaceous.

P. *leucocephala*, Fr. Crust smooth, glaucescent; perithecia subglobose, naked, black, coronate with the white, persistent, globuliform nucleus. *Fr. Lichenogr. p.* 450. — β. *Lecidina*, Fr.; crust somewhat leprous; disk dilated-scutelliform, rigescent, covered for the most part with a dense pale-yellowish-cinereous bloom. *Fr. l. c. Lecidea abietina, Ach.*

Trunks (β), Arctic America, *Rich.*

*** *Appendix to the Lichenes, &c.*

COLLEMACEÆ.

Filamentous, or foliaceous gelatinous-conglutinate plants without discrete layers. Sporidia included in asci, and immersed in a thalamium, which is contained either in a thalline exciple or a proper exciple.

Several genera are included here formerly referred to Lichenes, but separated by Fries, and with other genera constituted a distinct family, intermediate between Lichenes and aquatic Algæ. Collema and Leptogium may be said to have the thallus of Phyceæ with the apothecia of Lichenes, and Ephebe is considered by Fries nearly related to the Byssi.

SYNOPSIS.

Tribe I. COLLEMEÆ, Fr. — Thallus gelatinous-conglutinate, caulescent or foliaceous.

1. COLLEMA. Apothecia scutelliform, with a thalline exciple.
2. LEPTOGIUM. Apothecia scutelliform, with a proper exciple.

Tribe II. EPHEBIDEÆ. — Thallus filamentous, not gelatinous.

3. EPHEBE. Apothecia scutelliform, with a thalline exciple.

Tribe I. COLLEMEÆ, Fr.

I. COLLEMA, Hoffm.

Apothecia at first subglobose, becoming at length discoid-open and scutelliform, with a thalline exciple. Thallus corneous-gelatinous, somewhat pulpy, of a moniliform-filamentous texture, variously lobed.

* Thallus imbricate-plicate, becoming thick and turgid when wet.

1. C. *pulposum*, Ach. Thallus thick, suborbicular, very compact, blackish-green, of numerous, somewhat imbricate, plicate, rather entire or repand-crenate, erectish lobes, those of the circumference larger, somewhat appressed; apothecia somewhat crowded, slightly concave, rufous, with an elevated, irregular margin. *Ach. Syn. p.* 311. *Schær.! Spicil.* 2, *p.* 538 (*sub Parmelia*). *C. cristatum, Borr. in Hook. Br. Fl.* 2, *p.* 208. ICON, *Wulf. in Jacq. Coll.* 3, *p.* 139, *t.* 12, *f.* 1.

Upon rocks, among mosses. Pennsylvania, *Muhl.* I have not observed this species in the granite region of New England.

2. C. *plicatile*, Ach. Th. thick, orbicular, black-green; lobes rugose-plicate, ascending, laciniate; apoth. concave, of nearly the same

color with the thallus, with a thick, elevated margin. *Ach. Syn. p.* 314. *Hook. Br. Fl.* 2, *p.* 209. *Schær. Spicil.* 2, *p.* 543 (*sub Parmelia*). Exs. *Schleich.! Lich. Helv.*

Rocks (limestone, Schær.), New York, *Russell!* I have seen only a small fragment, but it appears to belong to this rather than to the preceding species.

3. C. *tenax*, Ach. Th. rather thick, suborbicular, glaucous-green, of somewhat plane, rounded, cut, or crenate lobes; apoth. scattered, at first urceolate, becoming rather elevated, concave, rufescent, with a somewhat entire margin. *Ach. Syn. p.* 314. — *β. pallescens*, Ach.; th. yellow-virescent, pale beneath, the lobes irregular, densely complicated, irregularly crenate, ascending; apoth. submarginal. *Ach. l. c.*

Rocks among mosses, Pennsylvania, *Muhl.!* New York, *Spreng.!* The cited specimens belong probably to the variety *β* of Acharius, but were not considered to differ from *α* by Floerke.

4. C. *fasciculare*, Ach. Th. suborbicular, imbricate-plicate, olive-green, the lobes dilated upward, waved, those of the circumference rounded, cut-crenate; apoth. marginal, at length elevated-subpedicellate, fasciculate, the disk somewhat convex, rufous. *Ach. Syn. p.* 317. *Fr.! Lich. Suec.* 50. Icon, *E. Bot. t.* 1162.

Trunks and rocks, New England. Pennsylvania, *Muhl.*

5. C. *pustulatum*, Ach. Th. substellate, lacerate-laciniate, the laciniæ expanded, plane, irregularly crenate, besprinkled above with paler pustules which pass at length into apothecia; disk punctiform, black. *Ach. Syn. p.* 351. *Parmelia leucoderma*, *Willd. herb.?*

Upon mosses, North America, *Ach.*, who says it is a minute species, very distinct from the last. Penn. (P. leucoderma, Willd.), *Muhl.!*

6. C. *granulatum*, Hook. Th. foliaceous, membranaceous, corrugated, granulated on both sides, imbricate-complicate, blackish-olive, the lobes somewhat rounded, waved and crisped, rather entire; apoth. scattered, sessile, blackish-fuscous, margin entire. *Hook. Br. Fl. p.* 2, 211. *Lichen granulatus*, *Huds.* (*e Hook.*). *Collema furvum*, *Ach.* Exs. *Schær.! Lich. Helv.* 413, 414. Icon, *E. Bot. t.* 1757.

Stones and trunks. New England. New York, *Halsey.* Pennsylvania? *Muhl.*

** Thallus thin, foliaceous, gelatinous-membranaceous, lobed principally at the circumference.

7. C. *melænum*, Ach. Th. foliaceous, somewhat stellate, blackish-

green, the lobes elongated, radiant, multifid, with elevated, waved and crisped, crenate margins; apoth. submarginal, somewhat plane, at length rufescent; with a subgranulate margin. *Ach.! Syn. p.* 315. — *β. jacobæifolium*, Ach.; laciniæ narrow, strict, lacerate-pinnatifid; apoth. marginal, with an entire margin. *Ach. l. c.* Exs. *Schær.! Lich. Helv.* 422.

Rocks among mosses and trunks. New England.

8. C. *palmatum*, Ach. Th. cæspitose-pulvinate, brownish-green, of crowded, erectish, palmate-divided, somewhat linear and terete laciniæ; apoth. rufous-fuscous. *Ach. Syn. p.* 319.

On the earth, and trunks. Pennsylvania, *Muhl.*

9. C. *nigrescens*, Ach. Th. somewhat monophyllous, membranaceous, expanded, round-lobed, rugose-plicate, olivaceous-nigrescent; costate-lacunose beneath; apoth. (minute) central, crowded, at length convex, rufous-fuscous, with a very entire margin. *Ach. Syn. p.* 321. *Hook. Br. Fl.* 2, *p.* 211. Exs. *Schær.! Lich. Helv.* 410.

Rocks and trunks. N. England. N. York, *Halsey*. Penn., *Muhl.*

10. C. *flaccidum*, Ach. Th. foliaceous, membranaceous, smooth, flaccid, blackish-green; lobes somewhat ascending, rounded, rather entire, undulate-plicate; apoth. scattered (small), somewhat plane, rufous. *Ach. Syn. p.* 322. *Hook. Br. Fl.* 2, *p.* 211. Exs. *Schær.! Lich. Helv.* 412.

Rocks and trunks. New England.

11. C. *tunæforme*, Ach. Th. foliaceous, membranaceous, somewhat rugose, blackish-green, besprinkled with fuliginous powder; lobes oblong, deeply cut, sinuate-laciniate, obtuse, flexuous, crisped, subcrenate; apoth. scattered, somewhat plane, fuscous, with a very entire margin. *Ach. Syn. p.* 322.

Rocks (especially limestone, Ach.). Pennsylvania, *Muhl.* in herb. Willd.! The specimen appeared to me to agree with an original one from Acharius. Schærer refers the species to C. flaccidum. It is said to occur in Massachusetts.

12. C. *pulchellum*, Ach. Th. membranaceous, orbicular, plane, somewhat laciniate, round-lobed at the circumference, plicate-papulose and dark-green above, beneath paler and deeply lacunose; apoth. crowded, elevated, the disk urceolate, pale, the margin thin, coarctate, very entire, at length somewhat rugulose. *Ach. Syn. p.* 321.

Trunks and rocks, New England. Pennsylvania, *Muhl.!* Ohio, *Mr. Lea!*

13. C. *saturninum*, Ach. Th. rosulate, blackish-green, glaucous and subtomentose beneath, the lobes broad, oblong, rounded, waved, very entire; apoth. scattered, somewhat plane, rufous, with a thin, entire margin. *Ach. Syn. p.* 320. *Hook. Br. Fl.* 2, *p.* 211. Exs. *Schær.! Helv.* 423.

Trunks and stones. New England. Arctic America, *Rich.* I have omitted several species of this genus, which require more observation.

II. LEPTOGIUM, Fr.

Apothecia rounded, becoming discoid-open and scutelliform, somewhat pedicellate, with a proper exciple. Thallus gelatinous-membranaceous, subdiaphanous, texture cellulose.

1. L. *Tremelloides*, Fr. Thallus foliaceous, membranaceous, very thin and somewhat diaphanous, smooth on both sides, or powdery above, lead-colored; lobes oblong, rounded, very entire; apothecia scattered, elevated, plane, rufous-fuscous, with a paler margin. *Fr. Fl. Scan. p.* 293. *Collema*, *Ach. Hook. Br. Fl.* 2, *p.* 213.

Rocks and trunks, New England. New York, *Torrey.* Pennsylvania, *Muhl.*

2. L. *lacerum*, Fr. Th. foliaceous, membranaceous, very thin and somewhat diaphanous; glaucous-fuscescent, the lobes small, subimbricate, lacerate-laciniate, denticulate-ciliate; apoth. (small) scattered, subsessile, somewhat concave, rufous, with a paler margin. *Fr.! Fl. Scan. p.* 293. *Collema*, *Ach. Hook. Br. Fl.* 2, *p.* 213.

On the earth, and rocks, among mosses. New England. New York, *Halsey.* Pennsylvania, *Muhl.*

3. L. *Burgessii*, Fr. Th. membranaceous, subimbricate, glaucous-fuscescent, somewhat spongy and downy beneath, the lobes rounded, sinuate-laciniate, crisped and minutely lacerate-dentate at the margins; apoth. depressed; disk somewhat concave, fuscous, with an elevated, lacerate-dentate or foliose margin. *Collema*, *Ach. Syn. p.* 320. *Hook.! Br. Fl.* 2, *p.* 211. Icon, *E. Bot. t.* 300.

Trunks. Mountains of New England.

Tribe II. EPHEBIDEÆ.

III. EPHEBE, Fr.

Apothecia formed from the thallus, from concave becoming plane,

and at length convex, black, the margin evanescent. Thallus filamentous, not gelatinous.

E. *pubescens*, Fr. Thallus decumbent, softish, terete, black, the branches entangled, capillaceous; apothecia of the same color. *Fr. Fl. Scan. p.* 294. *Cornicularia, Ach.* — *β. fibrillosa*, Ach.; thallus obscurely fuscous, smoothish, very delicate, branched, somewhat hirsute with numerous, flexuous, branched, subclavate fibres. *Cornicularia pubescens, var. fibrillosa, Ach. Syn. p.* 302.

Rocks and stones; — *α*, in alpine districts. Greenland, *Dill.* White Mountains. — *β*, North America, *Ach.*

Professor Peirce communicated to the Academy Mr. Sears C. Walker's elliptic elements of Neptune.

$$\left.\begin{aligned} \text{“}\pi &= 48^\circ\ 21'\ 2''.93 \\ \Omega &= 130\ \ 4\ 35.03 \end{aligned}\right\}\text{ mean equinox, Jan. 1, 1847.}$$

$$\begin{aligned} i &= 1\ 46\ 59.54. \\ e &= 0.00857741. \\ \mu &= 21''.55448. \\ M &= 328^\circ\ 31'\ 56''.36,\text{ mean noon, Greenwich, Jan. 1, 1847.} \\ T &= 164.6181\text{ tropical years.} \end{aligned}$$

“The normal elliptic places of Neptune, derived from the discussion of 689 observations, European and American (including the two ancient observations of Lalande), were as follows: —

I. —	18864^d =	May 9th, 1795,	215° 48′ 7″.68 — 44″.1	(r — 30.28778).
II. —	134 =	Aug. 20th, 1846,	326 45 30.83 — 1.2	(r' — 29.99256).
III. —	55 =	Nov. 7th, 1846,	327 13 58.57 — 227.6	(r'' — 29.99256).
IV. +	95 =	April 6th, 1847,	328 8 0.67 + 163.8	(r''' — 29.99256).
V. +	233 =	Aug. 20th, 1847,	328 57 44.39 + 1.0	(r'''' — 29.99256).

“These elliptic places were derived from Neptune's places in the instantaneous orbit, by the subtraction of the effect of the perturbations of all the other planets, as communicated to Mr. Walker by Professor Peirce in November last.

“The expressions for the heliocentric coördinates are, —

$$\begin{aligned} x &= [9.9998769]\ r\sin.(v + 138^\circ\ 21'\ 52''.13)\text{ m. eq. Jan. 1, 1847.} \\ y &= [9.9662265]\ r\sin.(v + \ \ 48\ 55\ 27.32). \\ z &= [9.5800962]\ r\sin.(v + \ \ 45\ \ 2\ 37.90). \end{aligned}$$

"Mr. Walker has applied to the elliptic values of v and r the perturbations δv and δr, which Professor Peirce communicated to him, and has compared the instantaneous values with the normal right ascensions and declinations, as follows: —

	δv	δr	Obs. — Eph. Δ A.	Obs. — Eph. Δ D.
	$''$		$''$	$''$
I.	+ 37.60	+ 0.01207	+ 1.9	— 1.3.
III.	+ 32.10	+ 0.01608	— 2.9	— 1.2.
IV.	+ 31.29	+ 0.01497	+ 0.8	+ 2.6.
V.	+ 29.49	+ 0.01493	— 0.2	+ 0.0.

"Mr. Walker has omitted the comparison of place II. because it is not the result of direct observation, like the rest. A closer representation might be obtained by least squares; but Mr. Walker prefers to wait for Mr. Peirce's new values of the perturbations."

Professor Peirce communicated his formulæ for the perturbations of Neptune's longitude and radius vector, resulting from his second approximation to the theory of Neptune. In his first approximation, Neptune's mean time of revolution was assumed to be just twice that of Uranus, and the eccentricity of Neptune's orbit was neglected. But the present approximation is based upon Mr. Walker's orbit, which has been presented to the Academy this evening, and includes all sensible terms as high as the cubes of the eccentricities.

"The masses of the disturbing planets, and the elements of their orbits, which are adopted in this theory, are the same with those adopted by Leverrier, in his theories of Mercury and Uranus, with the exception of the mass of Uranus, which is taken from Lamont's determination by observations of the satellites.

"The following notation is adopted in these formulæ: —

"t = the time in Julian years from Jan. 1, 1850.

"The mean longitude of each planet is denoted by the appropriate symbol of that planet.

"The Longitude of the perihelion of each planet is denoted by π with the symbol of the planet subjacent.

"The coefficient for correction of the mass of each planet is given in the usual form with the symbol of the planet subjacent.

"The formulæ are as follows: —

"δv = the perturbation of Neptune's true longitude =

$$
= (1 + \mu_{\text{♆}}) \left\{ \begin{array}{l}
+ 174''.37 \text{ sin. } (\text{♆} - \text{♅}) \\
- 8.63 \text{ sin. } 2\,(\text{♆} - \text{♅}) \\
- 1.70 \text{ sin. } 3\,(\text{♆} - \text{♅}) \\
- 0.54 \text{ sin. } 4\,(\text{♆} - \text{♅}) \\
- 0.21 \text{ sin. } 5\,(\text{♆} - \text{♅}) \\
- 0.09 \text{ sin. } 6\,(\text{♆} - \text{♅}) \\
- 0.04 \text{ sin. } 7\,(\text{♆} - \text{♅}) \\
- 0.02 \text{ sin. } 8\,(\text{♆} - \text{♅}) \\
- 0.01 \text{ sin. } 9\,(\text{♆} - \text{♅}) \\
- 0.01 \text{ sin. } 10\,(\text{♆} - \text{♅})
\end{array} \right\}
$$

$$
+ (1 + \mu_{\text{♆}}) \left\{ \begin{array}{l}
+ 1''.98 \text{ sin. } (\text{♆} - \pi_{\text{♅}}) \\
- 105.20 \text{ sin. } (2\,\text{♅} - \text{♆} - \pi_{\text{♅}}) \\
- 0.09 \text{ sin. } (2\,\text{♆} - \text{♅} - \pi_{\text{♅}}) \\
+ 14.71 \text{ sin. } (2\,\text{♆} - 3\,\text{♅} + \pi_{\text{♅}}) \\
- 0.01 \text{ sin. } (3\,\text{♆} - 2\,\text{♅} - \pi_{\text{♅}}) \\
- 0.39 \text{ sin. } (3\,\text{♆} - 4\,\text{♅} + \pi_{\text{♅}}) \\
- 0.09 \text{ sin. } (4\,\text{♆} - 5\,\text{♅} + \pi_{\text{♅}}) \\
- 0.03 \text{ sin. } (5\,\text{♆} - 6\,\text{♅} + \pi_{\text{♅}}) \\
- 0.01 \text{ sin. } (6\,\text{♆} - 7\,\text{♅} + \pi_{\text{♅}}) \\
- 0.004340\, t \text{ cos. } (\text{♅} - \pi_{\text{♅}})
\end{array} \right\}
$$

$$
+ (1 + \mu_{\text{♆}}) \left\{ \begin{array}{l}
+ 0''.23 \text{ sin. } (\text{♆} - \pi_{\text{♆}}) \\
+ 1668.30 \text{ sin. } (2\,\text{♅} - \text{♆} - \pi_{\text{♆}}) \\
+ 0.16 \text{ sin. } (2\,\text{♆} - \text{♅} - \pi_{\text{♆}}) \\
- 58.87 \text{ sin. } (2\,\text{♆} - 3\,\text{♅} + \pi_{\text{♆}}) \\
- 0.03 \text{ sin. } (3\,\text{♆} - 2\,\text{♅} - \pi_{\text{♆}}) \\
+ 1.50 \text{ sin. } (3\,\text{♆} - 4\,\text{♅} + \pi_{\text{♆}}) \\
- 0.02 \text{ sin. } (4\,\text{♆} - 3\,\text{♅} - \pi_{\text{♆}}) \\
+ 0.28 \text{ sin. } (4\,\text{♆} - 5\,\text{♅} + \pi_{\text{♆}}) \\
- 0.01 \text{ sin. } (5\,\text{♆} - 4\,\text{♅} - \pi_{\text{♆}}) \\
+ 0.10 \text{ sin. } (5\,\text{♆} - 6\,\text{♅} + \pi_{\text{♆}}) \\
- 0.01 \text{ sin. } (6\,\text{♆} - 5\,\text{♅} - \pi_{\text{♆}}) \\
+ 0.05 \text{ sin. } (6\,\text{♆} - 7\,\text{♅} + \pi_{\text{♆}}) \\
+ 0.03 \text{ sin. } (7\,\text{♆} - 8\,\text{♅} + \pi_{\text{♆}}) \\
+ 0.01 \text{ sin. } (8\,\text{♆} - 9\,\text{♅} + \pi_{\text{♆}}) \\
+ 0.018461\, t \text{ cos. } (\text{♅} - \pi_{\text{♆}})
\end{array} \right\}
$$

$$
+ (1 + \mu_{\text{♅}}) \left\{ \begin{array}{ll}
- & 0''.86 \sin. (3 \text{♆} - \text{♅} - 2 \pi_{\text{♆}}) \\
+ & 0.86 \sin. (\text{♅} - \text{♆}) \\
- & 0.01 \sin. (4 \text{♆} - \text{♅} - 3 \pi_{\text{♆}}) \\
+ & 0.01 \sin. (\text{♅} - \pi_{\text{♆}}) \\
+ & 13.55 \sin. (3 \text{♆} - \text{♅} - \pi_{\text{♆}} - \pi_{\text{♅}}) \\
- & 13.73 \sin. (\text{♅} - \text{♆} + \pi_{\text{♅}} - \pi_{\text{♆}}) \\
+ & 0.14 \sin. (4 \text{♆} - \text{♅} - 2 \pi_{\text{♆}} - \pi_{\text{♅}}) \\
- & 0.14 \sin. (\text{♅} + \pi_{\text{♅}} - 2 \pi_{\text{♆}}) \\
- & 3.62 \sin. (4 \text{♆} - 2 \text{♅} - 2 \pi_{\text{♆}}) \\
+ & 28.42 \sin. (4 \text{♆} - 2 \text{♅} - \pi_{\text{♆}} - \pi_{\text{♅}}) \\
- & 55.16 \sin. (4 \text{♆} - 2 \text{♅} - 2 \pi_{\text{♅}}) \\
- & 0.03 \sin. (5 \text{♆} - 2 \text{♅} - 3 \pi_{\text{♆}}) \\
+ & 0.03 \sin. (2 \text{♅} - 3 \text{♆} + \pi_{\text{♆}}) \\
+ & 0.23 \sin. (5 \text{♆} - 2 \text{♅} - 2 \pi_{\text{♆}} - \pi_{\text{♅}}) \\
- & 0.23 \sin. (2 \text{♅} - 3 \text{♆} + \pi_{\text{♅}}) \\
- & 0.09 \sin. (2 \text{♅} - 2 \text{♆} + \pi_{\text{♅}} - \pi_{\text{♆}}) \\
- & 0.45 \sin. (5 \text{♆} - 2 \text{♅} - \pi_{\text{♆}} - 2 \pi_{\text{♅}}) \\
+ & 0.45 \sin. (2 \text{♅} - 3 \text{♆} + 2 \pi_{\text{♅}} - \pi_{\text{♆}})
\end{array} \right\}
$$

$$
+ (1 + \mu_{\text{♅}}) \left\{ \begin{array}{ll}
- & 0''.06 \sin. (6 \text{♆} - 3 \text{♅} - 3 \pi_{\text{♆}}) \\
+ & 0.28 \sin. (3 \text{♅} - 5 \text{♆} + 2 \pi_{\text{♆}}) \\
+ & 0.66 \sin. (6 \text{♆} - 3 \text{♅} - 2 \pi_{\text{♆}} - \pi_{\text{♅}}) \\
- & 2.16 \sin. (3 \text{♅} - 5 \text{♆} + \pi_{\text{♆}} + \pi_{\text{♅}}) \\
- & 2.59 \sin. (6 \text{♆} - 3 \text{♅} - \pi_{\text{♆}} - 2 \pi_{\text{♅}}) \\
+ & 4.30 \sin. (3 \text{♅} - 5 \text{♆} + 2 \pi_{\text{♅}}) \\
+ & 2.72 \sin. (6 \text{♆} - 3 \text{♅} - 3 \pi_{\text{♅}}) \\
+ & 0.85 \sin. (2 \text{♆} - \text{♅} + \pi_{\text{♅}} - 2 \pi_{\text{♆}}) \\
- & 0.56 \sin. (\text{♅} - \text{♆} - \pi_{\text{♅}} + \pi_{\text{♆}}) \\
- & 0.66 \sin. (2 \text{♆} - \text{♅} - \pi_{\text{♆}}) \\
- & 0.03 \sin. (3 \text{♆} - \text{♅} - 2 \pi_{\text{♆}}) \\
+ & 4.38 \sin. (\text{♅} - \text{♆}) \\
+ & 0.13 \sin. (2 \text{♆} - \text{♅} - \pi_{\text{♅}}) \\
+ & 0.43 \sin. (3 \text{♆} - \text{♅} - \pi_{\text{♅}} - \pi_{\text{♆}}) \\
- & 0.43 \sin. (\text{♅} - \text{♆} + \pi_{\text{♅}} - \pi_{\text{♆}}) \\
+ & 0.24 \sin. (2 \text{♆} - \text{♅} - 2 \pi_{\text{♅}} + \pi_{\text{♆}}) \\
+ & 0.01 \sin. (3 \text{♆} - \text{♅} - 2 \pi_{\text{♅}})
\end{array} \right\}
$$

$$+ (1+\mu_{\text{♄}}) \left\{ \begin{array}{ll} + & 18''.60 \sin. (\text{♄} - \text{♆}) \\ - & 0.15 \sin. 2 (\text{♄} - \text{♆}) \\ - & 0.02 \sin. 3 (\text{♄} - \text{♆}) \end{array} \right\}$$

$$+ (1+\mu_{\text{♄}}) \left\{ \begin{array}{ll} - & 0''.08 \sin. (\text{♄} - \pi_{\text{♆}}) \\ + & 0.22 \sin. (\text{♄} - 2\,\text{♆} + \pi_{\text{♆}}) \\ - & 0.01 \sin. (2\,\text{♄} - 3\,\text{♆} + \pi_{\text{♆}}) \\ - & 0.003404\, t \cos. (\text{♆} - \pi_{\text{♆}}) \end{array} \right\}$$

$$+ (1+\mu_{\text{♄}}) \left\{ \begin{array}{ll} + & 0''.01 \sin. (\text{♄} - \pi_{\text{♄}}) \\ + & 0.28 \sin. (\text{♄} - 2\,\text{♆} + \pi_{\text{♄}}) \\ + & 0.54 \sin. (2\,\text{♄} - \text{♆} - \pi_{\text{♄}}) \\ + & 0.02 \sin. (2\,\text{♄} - 3\,\text{♆} + \pi_{\text{♄}}) \\ + & 0.009134\, t \cos. (\text{♆} - \pi_{\text{♄}}) \end{array} \right\}$$

$$+ (1+\mu_{\text{♃}}) \left\{ \begin{array}{ll} + & 34''.09 \sin. (\text{♃} - \text{♆}) \\ - & 0.02 \sin. 2 (\text{♃} - \text{♆}) \end{array} \right\}$$

$$+ (1+\mu_{\text{♃}}) \left\{ \begin{array}{ll} - & 0''.14 \sin. (\text{♃} - \pi_{\text{♆}}) \\ + & 0.42 \sin. (\text{♃} - 2\,\text{♆} + \pi_{\text{♆}}) \\ - & 0.02931\, t \cos. (\text{♆} - \pi_{\text{♆}}) \end{array} \right\}$$

$$+ (1+\mu_{\text{♃}}) \left\{ \begin{array}{ll} + & 0''.01 \sin. (\text{♃} - 2\,\text{♆} + \pi_{\text{♃}}) \\ + & 0.82 \sin. (2\,\text{♃} - \text{♆} - \pi_{\text{♃}}) \\ + & 0.003727\, t \cos. (\text{♆} - \pi_{\text{♃}}) \end{array} \right\}$$

$$+ (1+\mu_{\oplus})\, 0''.02 \sin. (\oplus - \text{♆})$$

" δr = the perturbation of Neptune's radius vector =

$$= (1+\mu_{\text{♅}}) \left\{ \begin{array}{l} + 0.00061 \\ - 0.01328 \cos. (\text{♅} - \text{♆}) \\ + 0.00097 \cos. 2 (\text{♅} - \text{♆}) \\ + 0.00023 \cos. 3 (\text{♅} - \text{♆}) \\ + 0.00008 \cos. 4 (\text{♅} - \text{♆}) \\ + 0.00003 \cos. 5 (\text{♅} - \text{♆}) \\ + 0.00001 \cos. 6 (\text{♅} - \text{♆}) \\ + 0.00001 \cos. 7 (\text{♅} - \text{♆}) \end{array} \right\}$$

$$+(1+\mu_{\text{♆}})\left\{\begin{array}{l}
-0.00012 \cos.(\text{♆}-\pi_{\text{♅}}) \\
+0.00055 \cos.(2\,\text{♅}-\text{♆}-\pi_{\text{♅}}) \\
+0.00001 \cos.(2\,\text{♆}-\text{♅}-\pi_{\text{♅}}) \\
-0.00101 \cos.(2\,\text{♆}-3\,\text{♅}+\pi_{\text{♅}}) \\
+0.00004 \cos.(3\,\text{♆}-4\,\text{♅}+\pi_{\text{♅}}) \\
+0.00001 \cos.(4\,\text{♆}-5\,\text{♅}+\pi_{\text{♅}}) \\
-0.000000819\, t \sin.(\text{♅}-\pi_{\text{♅}})
\end{array}\right\}$$

$$+(1+\mu_{\text{♆}})\left\{\begin{array}{l}
-0.00003 \cos.(\text{♆}-\pi_{\text{♆}}) \\
-0.00666 \cos.(2\,\text{♅}-\text{♆}-\pi_{\text{♆}}) \\
+0.00001 \cos.(2\,\text{♆}-\text{♅}-\pi_{\text{♆}}) \\
+0.00403 \cos.(2\,\text{♆}-3\,\text{♅}+\pi_{\text{♆}}) \\
-0.00016 \cos.(3\,\text{♆}-4\,\text{♅}+\pi_{\text{♆}}) \\
-0.00004 \cos.(4\,\text{♆}-5\,\text{♅}+\pi_{\text{♆}}) \\
-0.00002 \cos.(5\,\text{♆}-6\,\text{♅}+\pi_{\text{♆}}) \\
-0.00001 \cos.(6\,\text{♆}-7\,\text{♅}+\pi_{\text{♆}}) \\
+0.000001362\, t \sin.(\text{♅}-\pi_{\text{♆}})
\end{array}\right\}$$

$$+(1+\mu_{\text{♆}})\left\{\begin{array}{l}
+0.00005 \cos.(3\,\text{♅}-\text{♆}-\pi_{\text{♅}}-\pi_{\text{♆}}) \\
+0.00003 \cos.(\text{♆}-\text{♅}+\pi_{\text{♆}}-\pi_{\text{♅}}) \\
+0.00005 \cos.(4\,\text{♅}-2\,\text{♆}-2\,\pi_{\text{♅}}) \\
-0.00048 \cos.(4\,\text{♅}-2\,\text{♆}-\pi_{\text{♅}}-\pi_{\text{♆}}) \\
+0.00095 \cos.(4\,\text{♅}-2\,\text{♆}-2\,\pi_{\text{♆}})
\end{array}\right\}$$

$$+(1+\mu_{\text{♄}})\left\{\begin{array}{l}
+0.00310 \\
+0.00275 \cos.(\text{♄}-\text{♅}) \\
+0.00003 \cos.\,2\,(\text{♄}-\text{♅})
\end{array}\right\}$$

$$+(1+\mu_{\text{♄}})\left\{\begin{array}{l}
-0.00002 \cos.(\text{♄}-\pi_{\text{♅}}) \\
+0.00002 \cos.(\text{♄}-2\,\text{♅}+\pi_{\text{♅}}) \\
-0.0000002513\, t \sin.(\text{♅}-\pi_{\text{♅}})
\end{array}\right\}$$

$$+(1+\mu_{\text{♄}})\left\{\begin{array}{l}
-0.00004 \cos.(\text{♄}-2\,\text{♅}+\pi_{\text{♄}}) \\
+0.00008 \cos.(2\,\text{♄}-\text{♅}-\pi_{\text{♄}}) \\
+0.0000006742\, t \sin.(\text{♅}-\pi_{\text{♄}})
\end{array}\right\}$$

$$+(1+\mu_{\text{♃}})\left\{\begin{array}{l} +0.00978 \\ +0.00497\cos.(\text{♃}-\text{♆}) \end{array}\right\}$$

$$+(1+\mu_{\text{♃}})\left\{\begin{array}{l} -0.00004\cos.(\text{♃}-\pi_{\text{♆}}) \\ +0.00004\cos.(\text{♃}-2\,\text{♆}-\pi_{\text{♆}}) \\ -0.0000002163\,t\sin.(\text{♆}-\pi_{\text{♆}}) \end{array}\right\}$$

$$+(1+\mu_{\text{♃}})\left\{\begin{array}{l} +0.00012\cos.(2\,\text{♃}-\text{♆}-\pi_{\text{♃}}) \\ +0.0000002751\,t\sin.(\text{♆}-\pi_{\text{♃}}) \end{array}\right\}$$

$$+(1+\mu_{\text{♂},\,\oplus,\,\text{♀},\,\text{☿}})\,0.00006.$$

"These formulæ may be exhibited in the following form, which is similar to that adopted by the illustrious Leverrier, in his theory of Mercury, and very convenient for the construction of tables. The coefficients for the corrections of the masses are hereafter omitted.

$$\begin{array}{rl}
\delta v = & -\;8''.63\sin.2(\text{♅}-\text{♆}) \\
& -\;1.70\sin.3(\text{♅}-\text{♆}) \\
& -\;0.54\sin.4(\text{♅}-\text{♆}) \\
& -\;0.21\sin.5(\text{♅}-\text{♆}) \\
& -\;0.09\sin.6(\text{♅}-\text{♆}) \\
& -\;0.04\sin.7(\text{♅}-\text{♆}) \\
& -\;0.02\sin.8(\text{♅}-\text{♆}) \\
& -\;0.01\sin.9(\text{♅}-\text{♆}) \\
& -\;0.01\sin.10(\text{♅}-\text{♆}) \\
& +\;18.60\sin.(\text{♄}-\text{♆}) \\
& -\;0.15\sin.2(\text{♄}-\text{♆}) \\
& -\;0.02\sin.3(\text{♄}-\text{♆}) \\
& +\;34.09\sin.(\text{♃}-\text{♆}) \\
& -\;0.02\sin.2(\text{♃}-\text{♆}) \\
& +\;0.02\sin.(\oplus-\text{♆}) \\
& +\;k\sin.(\text{♆}+\varphi)+A.
\end{array}$$

$$
\begin{aligned}
\delta r = \; & 0.01365 \\
& + 0.00097 \cos. 2\,(\text{♅} - \text{♆}) \\
& + 0.00023 \cos. 3\,(\text{♅} - \text{♆}) \\
& + 0.00008 \cos. 4\,(\text{♅} - \text{♆}) \\
& + 0.00003 \cos. 5\,(\text{♅} - \text{♆}) \\
& + 0.00001 \cos. 6\,(\text{♅} - \text{♆}) \\
& + 0.00001 \cos. 7\,(\text{♅} - \text{♆}) \\
& + 0.00275 \cos. (\text{♄} - \text{♆}) \\
& + 0.00003 \cos. 2\,(\text{♄} - \text{♆}) \\
& + 0.00497 \cos. (\text{♃} - \text{♆}) \\
& + h \cos. (\text{♆} - \theta) + B.
\end{aligned}
$$

"In these equations, k, h, φ, θ, A, and B are determined by the following formulæ: —

$$
\begin{aligned}
k \cos. \varphi = \; & 1''.87 \cos. (\text{♅} - \text{♆} + 306^\circ\, 5'\, 13'') \\
& + 0.22 \cos. [2\,(\text{♅} - \text{♆}) + 171\;\, 28] \\
& + 1.76 \cos. [3\,(\text{♅} - \text{♆}) + \;\;0\;\, 5] \\
& + 0.35 \cos. [4\,(\text{♅} - \text{♆}) + 221\;\, 30] \\
& + 0.13 \cos. 5\,(\text{♅} - \text{♆}) \\
& + 0.07 \cos. 6\,(\text{♅} - \text{♆}) \\
& + 0.03 \cos. [7\,(\text{♅} - \text{♆}) + 348] \\
& + 0.01 \cos. [8\,(\text{♅} - \text{♆}) + 348] \\
& + 0.44 \cos. (\text{♄} - \text{♆} + 242\;\, 47) \\
& + 0.55 \cos. [2\,(\text{♄} - \text{♆}) + 271\;\;\, 3] \\
& + 0.44 \cos. (\text{♃} - \text{♆} + 208\;\, 18) \\
& + 0.82 \cos. [2\,(\text{♃} - \text{♆}) + 348\;\;\, 9]
\end{aligned}
$$

$$
\begin{aligned}
k \sin. \varphi = \; & 1''.87 \sin. (\text{♅} - \text{♆} + 306^\circ\, 5'\, 13'') \\
& + 0.22 \sin. [2\,(\text{♅} - \text{♆}) + 171\;\, 28] \\
& + 1.70 \sin. [3\,(\text{♅} - \text{♆}) + 178\;\, 45] \\
& + 0.32 \sin. [4\,(\text{♅} - \text{♆}) + 180] \\
& + 0.11 \sin. [5\,(\text{♅} - \text{♆}) + 180] \\
& + 0.05 \sin. [6\,(\text{♅} - \text{♆}) + 180] \\
& + 0.03 \sin. [7\,(\text{♅} - \text{♆}) + 168] \\
& + 0.01 \sin. [8\,(\text{♅} - \text{♆}) + 168] \\
& + 0.51 \sin. (\text{♄} - \text{♆} + \;\;77\;\;\, 0) \\
& + 0.55 \sin. [2\,(\text{♄} - \text{♆}) + 268\;\, 55] \\
& + 0.46 \sin. [\text{♃} - \text{♆} + \;\;64\;\;\, 0] \\
& + 0.82 \sin. [2\,(\text{♃} - \text{♆}) + 348\;\;\, 9]
\end{aligned}
$$

$$
\begin{aligned}
h \cos.\, \theta = {} & 0.00011 \cos.\, (♅ - ♆ + 121^\circ) \\
& + 0.00001 \cos.\, [2\,(♅ - ♆) + 252] \\
& + 0.00015 \cos.\, [3\,(♅ - ♆) + 333] \\
& + 0.00004 \cos.\, [4\,(♅ - ♆) + 333] \\
& + 0.00002 \cos.\, [5\,(♅ - ♆) + 348] \\
& + 0.00001 \cos.\, [6\,(♅ - ♆) + 348] \\
& + 0.00001 \cos.\, (♄ - ♆ + 270) \\
& + 0.00008 \cos.\, [2\,(♄ - ♆) + 270] \\
& + 0.00005 \cos.\, (♃ - ♆ + 90) \\
& + 0.00002 \cos.\, [2\,(♃ - ♆) + 348]
\end{aligned}
$$

$$
\begin{aligned}
h \sin.\, \theta = {} & 0.00011 \sin.\, (♅ - ♆ + 301^\circ) \\
& + 0.00001 \sin.\, [2\,(♅ - ♆) + 72] \\
& + 0.00015 \sin.\, [3\,(♅ - ♆) + 333] \\
& + 0.00003 \sin.\, [4\,(♅ - ♆) + 333] \\
& + 0.00002 \sin.\, [5\,(♅ - ♆) + 348] \\
& + 0.00001 \sin.\, [6\,(♅ - ♆) + 348] \\
& + 0.00005 \sin.\, (♄ - ♆ + 325) \\
& + 0.00008 \sin.\, [2\,(♄ - ♆) + 90] \\
& + 0.00005 \sin.\, (♃ - ♆) \\
& + 0.00012 \sin.\, [2\,(♃ - ♆) + 168]
\end{aligned}
$$

$$
\begin{aligned}
A = {} & 0.022332\, t \sin.\, (♆ + 284^\circ\, 56'\, 38'') \\
& + 187.33 \sin.\, (♅ - ♆ + 38\; 24\; 43) \\
& + 1724.04 \sin.\, (2\,♆ - ♅ + 188\; 42\; 10) \\
& + 67.93 \sin.\, (2\,♅ - 3\,♆ + 358\; 40\; 0) \\
& + 14.45 \sin.\, (3\,♆ - ♅ + 140\; 55\; 30) \\
& + 0.15 \sin.\, (4\,♆ - ♅ + 90\; 0) \\
& + 0.14 \sin.\, (♅ + 257\; 55) \\
& + 73.23 \sin.\, (4\,♆ - 2\,♅ + 181\; 20\; 17) \\
& + 0.59 \sin.\, (5\,♆ - 2\,♅ + 134\; 19) \\
& + 2.85 \sin.\, (6\,♆ - 3\,♅ + 87\; 47\; 23) \\
& + 5.66 \sin.\, (3\,♅ - 5\,♆ + 358\; 16\; 47) \\
& + 0.09 \sin.\, (2\,♅ - 2\,♆ + 300)
\end{aligned}
$$

$$
\begin{aligned}
B = {} & 0.0000030384\, t \sin.\, (♆ + 257^\circ\, 27'\, 18'') \\
& + 0.01326 \cos.\, (♅ - ♆ + 179\; 56\; 48) \\
& + 0.00696 \cos.\, (2\,♆ - ♅ + 7\; 51\; 1) \\
& + 0.00462 \cos.\, (2\,♅ - 2\,♆ + 179\; 7\; 45) \\
& + 0.00005 \cos.\, (3\,♆ - ♅ + 149) \\
& + 0.00116 \cos.\, (4\,♆ - 2\,♅ + 3\; 29\; 5)
\end{aligned}
$$

"The terms A and B include the secular terms, and also those of long period as well as those which acquire large coefficients by the small divisors, which depend upon the near approach to commensurability in the mean motions of Neptune and Uranus. These coefficients will vary very sensibly by a change in the value of the mean motion of Neptune arising from a more accurate determination of its orbit. But the principal effect of these terms can for a limited period, such as a century, for instance, be included in the ordinary forms of elliptic motion, and the residual portion will assume a secular form, which is no more liable to change, from a new correction of the mean motion of Neptune, than the other small coefficients of the equations of perturbation. The elliptic portions of A and B may therefore be neglected until longer observation has given a more precise value of Neptune's mean motion, and the residual portion is contained in the following equation.

$$
\begin{aligned}
A = {} & 1.98 \quad \sin.\,(2\,\text{♅} + 221^\circ\,46')'' \\
& + 0.36517\,t \quad \sin.\,(\text{♅} + 20^\circ\,58'\,12'') \\
& + 0.0002\,t \quad \sin.\,(2\,\text{♅} + 322) \\
& - 0.0020714\,t^2 \\
& + 0.0004027\,t^2 \sin.\,(\text{♅} + 230^\circ\,3')
\end{aligned}
$$

$$
\begin{aligned}
B = {} & - 0.00066 \\
& + 0.00134 \quad \cos.\,(\text{♅} + 38^\circ\,40') \\
& + 0.0000115\,t \\
& + 0.00002827\,t \quad \sin.\,(\text{♅} + 286^\circ\,32'\,23'') \\
& + 0.0000000300\,t^2 \cos.\,(\text{♅} + 125\ \ 1)
\end{aligned}
$$

"The following particular values of δv and δr, derived from the preceding formulæ, will be useful in computing the orbit of Neptune from observation.

	δv	δr
	$''$	
May 9, 1795,	+ 47.80	+ 0.01283
October 1, 1846,	+ 27.03	+ 0.01793
January 1, 1847,	+ 27.13	+ 0.01728
April 1, "	+ 26.68	+ 0.01664
July 1, "	+ 25.75	+ 0.01602
October 1, "	+ 24.37	+ 0.01544

January 1, 1848,	+ 22.58	+ 0.01491
April 1, "	+ 20.40	+ 0.01443
July 1, "	+ 17.89	+ 0.01400
October 1, "	+ 15.12	+ 0.01363
January 1, 1849,	+ 12.18	+ 0.01332
April 1, "	+ 9.06	+ 0.01308
July 1, "	+ 5.84	+ 0.01290
October 1, "	+ 2.59	+ 0.01277
January 1, 1850,	— 0.64	+ 0.01270
April 1, "	— 3.83	+ 0.01270
July 1, "	— 6.96	+ 0.01276
October 1, "	— 9.96	+ 0.01288
January 1, 1851,	— 12.64	+ 0.01308."

Professor Peirce also communicated the following elements of the orbit of the satellite of Neptune, computed from the combination of all of Lassell's and Mr. Bond's observations; and he also communicated the corresponding mass of the primary.

"Time of sidereal revolution, 5 days 21 hours 12.4 minutes.

"Inclination to ecliptic, 29°.9.

"Longitude of ascending node (the motion being supposed direct), 119°.8.

"Time of greatest northern elongation, November $26^{d}.53$, Greenwich mean solar time.

"Greatest elongation, 16″.5.

"Distance of satellite from Neptune, 230,000 miles.

"Corresponding mass of Neptune, $\frac{1}{18780}$, the mass of sun being unity.

"The time of sidereal revolution is not liable to an error of more than a few minutes, and the greatest elongation cannot be less than 16″.3, or more than 17″.0. The mass of Neptune, therefore, cannot be less than $\frac{1}{19600}$, or greater than $\frac{1}{17600}$."

Three Hundred and second Meeting.

January 4, 1848. — MONTHLY MEETING.

The PRESIDENT in the chair.

Mr. Everett read a letter from M. Leverrier, acknowledging his election as a Corresponding Member of the Academy.

Mr. Everett also submitted to the Academy a paper received from M. Leverrier, containing a succinct abstract of the first of two memoirs lately read by him to the Academy of Sciences at Paris, on the subject of periodical comets. It was the intention of M. Leverrier that this communication should reach the Academy in advance of the publication of the *Compte Rendu* for the 25th of October, in which the abstract of the first memoir appears *in extenso*. Owing to the great length of the passage of the vessel by which M. Leverrier's communication was transmitted, this expectation was disappointed. As the *Compte Rendu*, however, of course possesses but a limited circulation in this country, a translation of this interesting paper was read by Mr. Everett to the Academy.

After alluding to the stability of the orbits of the planets, caused by their moderate eccentricity, small inclination, and the great preponderance of the central force, M. Leverrier observes, that

"It is not so with respect to the comets. Those of them, which move in planes but little inclined to the ecliptic, cut very near the orbits of one or more of the planets. It may accordingly happen, that they will pass in the neighbourhood of the planets themselves, and that the disturbing force, thus rendered preponderant, may turn them from their course. Thus the comet, which, left to itself, would have continued to move in a parabola, may by the action of Jupiter be brought for ever, or only for a limited period, into an ellipse of moderate extent. The same cause which shall have compelled the comet to describe this ellipse may be able hereafter again to control its movement, and to force it for ever from our planetary system, by throwing it into a hyperbolic curve."

M. Leverrier then adverts to the discovery of a comet by Messier in 1770, which was afterwards known as Lexell's, in

consequence of its being discovered by that astronomer to move in an elliptical orbit of five years and a half period. To the objection made against this theory, that it had not before been seen, Lexell replied, that it might be a new comet, drawn into an elliptical orbit by the action of Jupiter, and that it would approach that planet again in 1779, which might then, perhaps, throw it off from our system, to return no more. In point of fact, astronomers have looked in vain for the return of Lexell's comet!

In the month of November, 1843, M. Faye saw a comet, whose observed movement could not be reduced to a parabolic curve. Dr. Goldschmidt discovered that it described an ellipse of a period of seven years and a half. The objection to this theory, that it ought to have been seen before, was answered, as in the case of Lexell's comet, by reference to the action of Jupiter.

As the region of the heavens where this approach to Jupiter took place was nearly the same for both comets, M. Leverrier was led to admit the possibility, that the comets of 1770 and 1843 might be the same, although their orbits were altogether different.

In 1844, M. de Vico, at Rome, discovered a comet, which was shown by M. Faye to move in an orbit of five years and a half. The possibility that this was Lexell's comet of course conflicted with M. Leverrier's first impressions, just mentioned, but increased the probability that Lexell's comet might be recovered in one or the other of the recent discoveries.

"The only difficulty," says M. Leverrier, "was, that the calculations became immensely laborious, and I was obliged to devote to them several years, including the last (1846). Although my researches are brought to a close, however great my desire to submit them to the Academy, the necessity of passing some days in collecting the documents relative to the comet of De Vico will oblige me to confine myself at present to that of M. Faye."

The elements of the comet of 1770, being different from

those of the comets of 1843 and 1844, M. Leverrier first undertook to follow the former into the neighbourhood of Jupiter and the other regions which it would have traversed up to the years 1843 and 1844, and to ascertain, in this way, if the comet of 1770 might not place itself upon the orbits of one or the other of those discovered by M. Faye or M. Vico.

On approaching the subject more nearly, M. Leverrier found that the calculations of Laplace, in the *Mécanique Céleste*, as to the direction given by Jupiter to the comet of 1770, could not be depended on. Slight changes in the elements of the orbit give routes so different to the aphelion, that it remains uncertain whether it passed within or beyond the orbit of Jupiter, through the system of the satellites or outside of them. M. Leverrier was accordingly obliged to commence by studying the movement of the comet of 1770, leaving to it all the latitude which resulted from the observations made at the time. In pursuing this course,

"I established," says M. Leverrier, "the following points: —

"1. That it was impossible that the comet should have been arrested within the system of Jupiter, without falling into the planet itself; an event very improbable, it is true, without being absolutely inadmissible.

"2. I showed that Jupiter might have forced the comet to pass off in an hyperbola round the sun. In this case, we could not expect to see it again, as it would continually move on to a greater distance from our system, to enter into other spheres of attraction.

"3. It is possible that the comet, after having escaped the action of Jupiter, might have pursued its course in ellipses of very long period. But it is much more probable that it continued to move in ellipses whose moderate period must permit us often to witness its return. I have formed a complete table of all the possible ellipses, which will serve henceforth as the basis of our further inquiries."

The first inquiry will, then, be, whether the elements of the new comet (that of Faye), as calculated from the observations, present themselves among the systems of this table. If so, the problem is solved.

Should this not be the case, it will be necessary to inquire

if the new comet may not have experienced perturbations since 1779, which would account for the present want of coincidence in the elements with those of Lexell's comet in the table. If no such considerable deviation from a regular course can be admitted as probable, the hypothesis of identity with the comet of 1770 must be given up.

But if the new comet has experienced considerable perturbations since 1779, these must be calculated before we can pronounce against the suspected identity. As the observations made at one appearance cannot be depended upon as a sufficient foundation for fixing its position for a period of more than sixty years, it became necessary to pursue the same course, in reference to the new comet, which had been followed in regard to Lexell's, and "to determine all the positions which it could have occupied in 1779, and the elements of all the orbits in which it could have moved conformably with the recent observations."

The great complexity and difficulty of the problem undertaken by M. Leverrier are now apparent. He proceeds to solve it by examining the positions and elements of the comet of Faye, in the reverse order of time, during several successive periods, viz.: 1. from 1843 to 1839; 2. from 1839 to 1819; 3. from 1819 to 1814; 4. from 1814 to 1797; 5. from 1797 to 1792.

The paper of M. Leverrier, as transmitted to the American Academy, being itself an abstract of the memoir read to the Academy of Sciences at Paris, hardly admits, in this portion of it, a further condensation, which could not be made without impairing the clearness of the discussion. At the close of the examination of these successive periods, M. Leverrier arrives at the definite conclusion, "*that the periodical comets of Faye and Lexell are two different bodies.*"

In concluding the memoir, M. Leverrier briefly considers the question, *At what time did the action of Jupiter give to the comet its present orbit?* Or rather, *What is the least remote time at which this phenomenon may have taken place?*

He establishes this least remote period at the year 1747. It is possible that the comet in question may have received, on its approach to Jupiter in that year, the impulse which placed it in its present orbit, and that it was consequently discovered by M. Faye on its thirteenth return.

Professor Peirce read some correspondence between Dr. Gerling of Marburg and Lieutenant Gillis, communicated by the latter, and offered the following resolutions, which were adopted.

"*Resolved*, That, in the opinion of this Academy, the enterprise for determining the solar parallax, in the method proposed in the correspondence between Lieutenant Gillis and Dr. Gerling, is worthy to be promoted by the government of the United States, by sending an expedition to Chiloë, both on account of the great uncertainty which attends the adopted value of this fundamental basis of astronomical measurement, and the probability that this attempt will prove successful, and thus redound to the honor of the country by which it is undertaken.

"*Resolved*, That a copy of the above resolution be transmitted by the Corresponding Secretary to Lieutenant Gillis, with a request that he will communicate it to the public authorities who may have this subject under consideration."

Professor Peirce also reported some of Mr. George P. Bond's observations upon the nebula in Andromeda.

Mr. Paine stated the results of his meteorological observations upon the present extraordinarily mild winter.

Three hundred and fourth Meeting.

January 26, 1848. — QUARTERLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters of acceptance from the Hon. Abbott Lawrence and Professor Edward H. Courtenay, who were chosen Fellows at the last quarterly meeting.

Mr. Everett read a communication from Professor Nichol, directing attention to certain deficiencies in the meteorological records as printed in the Academy's Memoirs; whereupon,

some remarks having been made upon the desirability of printing Dr. Holyoke's meteorological journal *in extenso*, the original manuscript, along with Professor Nichol's letter, was referred to a committee, consisting of Messrs. Hale, Paine, and Gould.

Mr. Everett read extracts from a letter of Professor Schumacher of Altona, stating the conditions required to be observed by the candidates for the medal awarded by the king of Denmark to the discoverers of telescopic comets. As the conditions in respect to the immediate transmission of intelligence to the proper persons are indispensable, and appear not to be well known in this country, Mr. Everett read a translation from the original German, in the *Astronomische Nachrichten*, No. 400, which, for the sake of wider dissemination, is herewith given in the subjoined note.*

* A gold medal of 20 ducats' value was offered by the predecessor of the late king of Denmark to the discoverer of a telescopic comet. This foundation was confirmed by the late king, by whose authority the following regulations were established: —

1. The model will be given to the first discoverer of any comet, which at the time of its discovery is invisible to the naked eye, and whose periodic time is unknown.

2. The discoverer, if a resident in any part of Europe except Great Britain, is to make known his discovery directly to Mr. Schumacher at Altona. If a resident in Great Britain, or any other quarter of the globe, except the Continent of Europe, he is to make his discovery known directly to Mr. Francis Baily, London. — [Since Mr. Baily's decease, G. B. Airy, Esq., Astronomer Royal, has been substituted in this and in the 7th and 8th articles of the regulations.]

3. This communication must be made by the *first post* after the discovery. If there is no regular mail at the place of discovery, the first opportunity of any other kind must be made use of, without waiting for other observations. Exact compliance with this condition is indispensable. If this condition is not complied with, and only one person discovers the comet, no medal will be given for the discovery. Otherwise, the medal will be assigned to the discoverer who earliest complies with the condition.

4. The communication must not only state as exactly as possible the time of the discovery, in order to settle the question between rival claims, but also as near as may be the place of the comet, and the direction in which it is moving, as far as these points can be determined, from the observations of one night.

5. If the observations of one night are not sufficient to settle these points, the annunciation of the discovery must still be made, in compliance with the third

Messrs. Edward Desor and Charles Jackson, Jr., were elected Fellows of the Academy.

Professor Spencer F. Baird, of Carlisle, Pennsylvania, was elected a Corresponding Member.

Three hundred and fifth Meeting.

February 1, 1848. — Monthly Meeting.

The President in the chair.

Professor Horsford read extracts from a letter from Professor Liebig, communicating the results of some experiments made with a view to determine the permeability of membranes to air, water, and various solutions. He has arrived at the conclusion, that the secretions from the blood-vessels and alimentary canal are directly produced by the evaporation from the skin and lungs, on the one hand, and the pressure of the atmosphere on the other.

Professor Horsford also made the observation, that chloroform, and several other compounds which taste sweet, may be written in the list of the various sweet bodies enumerated in his paper upon Glycocoll. To illustrate this he presented the following formulæ : —

"*Sweet Bodies.*

$C_{12} H_{10} O_{10}$ = Milk Sugar.
$C_{12} H_{11} O_{11}$ = Cane Sugar.
$C_{12} H_{12} O_{12}$ = Grape Sugar.

article. As soon as a second observation is made, it must be communicated in like manner with the first, and with it the longitude of the place where the discovery is made, unless it take place at some known observatory. The expectation of obtaining a second observation will never be received as a satisfactory reason for postponing the communication of the first.

6. The medal will be assigned twelve months after the discovery of the comet, and no claim will be admitted after that period.

7. Messrs. Baily and Schumacher are to decide if a discovery has been made. If they differ, Mr. Gauss of Göttingen is to decide.

8. Messrs. Baily and Schumacher have agreed to communicate mutually to each other every announcement of a discovery.

Altona, April, 1840.

$$C_4\,H_4\,O_4 = \tfrac{1}{3}\ \text{of Grape Sugar.}$$

$$C_4\,H_2 \begin{array}{c}H\\H\\O\end{array} O_3 = \text{“} \quad \text{“}$$

$$C_4\,H_2 \begin{array}{c}H\\H\\N\end{array} O_3 = \text{Sugar of Glue. Glycocoll.}$$

$$C_4\,H_2 \begin{array}{c}H\\Pb\\O\end{array} O_3 = \text{Sugar of Lead.}$$

$$C_4\,H_2 \begin{array}{c}O\\Pb\\O\end{array} O_3 = \tfrac{1}{2}\ \text{Citrate of Lead.}$$

$$C_4\,H_2 \begin{array}{c}H\\K\\O\end{array} O_3 = \text{Acetate of Potassa.}$$

$$C_4\,H_2 \begin{array}{c}H\\H\\N\end{array} O_3,\ H,\ O, = \text{Nitric Ether.}$$

$$C_4\,H_2 \begin{array}{l}H\\H\\H_{\frac{2}{3}}\,O_{\frac{1}{3}}\end{array} O_3 = \tfrac{2}{3}\ \text{Glycerile oxide.}$$

$$C_4\,H_2 \begin{array}{c}Cl\\Cl\\Cl\end{array} Cl_3 \div 2 = \text{Chloroform.}$$

$$C_4\,H_2 \begin{array}{c}Br\\Br\\Br\end{array} Br_3 \div 2 = \text{Bromoform.*}$$

$$C_4\,H_2 \begin{array}{c}I\\I\\I\end{array} I_3 \div 2 = \text{Iodoform.}$$

$$C_4\,H_2 \begin{array}{c}I\\I\\Cl\end{array} Cl_3 \div 2 = \text{Chloro-iodoform.}$$

$$C_4\,H_2 \begin{array}{c}Br\\Br\\I\end{array} I_3 \div 2 = \text{Bromo-iodoform.}$$

$$C_4\,H_2 \begin{array}{c}H\\H\\H\end{array} \begin{array}{c}H\\Fl_2\end{array} \div 2 = \text{Hydrofluate of Methylene.†}$$

* For the observation that this and the following four bodies may be included in the series, the author is indebted to his friend Dr. Peirce, of the Cambridge Laboratory.

† The hydrofluate of methylene has a pleasant ethereal smell.

$$C_4\,H_2\,\underset{S}{\overset{S}{S}}\,S_3 \div 2 \quad = \text{Sulphoform. (?)}$$

$$C_4\,H_2\,\underset{H}{\overset{H}{H}}\,\begin{matrix}H\\Cl_2\end{matrix} \div 2 \quad = \text{Chloride of Methyle.}$$

$$\begin{matrix}C_2\\S_2\end{matrix}\,H_2\,\underset{O}{\overset{O}{Ag}}\,O_3,\,H,\,O = \text{Methyl-sulphite of Silver.}$$

$$\begin{matrix}C_2\\S_2\end{matrix}\,H_2\,\underset{O}{\overset{O}{Pb}}\,O_3,\,H,\,O = \text{Methyl-sulphite of Lead.}$$

$$\begin{matrix}C_2\\S_2\end{matrix}\,H,\,Ag,\,\underset{O}{\overset{O}{Cl}}\,O_3,\,H,\,O = \text{Chloro-methyl-sulphite of Silver.}$$

$$\begin{matrix}C_2\\S_2\end{matrix}\,H,\,Pb,\,\underset{O}{\overset{O}{Cl}}\,O_3,\,H,\,O = \text{Chloro-methyl-sulphite of Lead.}$$

$$S_4\,Ag_2\,\underset{O}{\overset{O}{O}}\,O_3 \div 2 \quad = \text{Hypo-sulphite of Silver.}$$

"It is not to be denied that there are bodies having the number of atoms occurring in sugar, and yet not tasting sweet. Still, the correspondence in constitution among so many bodies, containing such a variety of elements, and all having the common property of sweetness, is an interesting fact. ***Do sweet bodies owe their sweetness to a common arrangement of their ultimate particles?*** or, in other words, ***Have sweet bodies a common form?***

"It may further be remarked, that the constitution of acids, as suggested by Davy in relation to inorganic acids, and applied by Liebig to organic acids, permits them to be written in a common formula $= H + x$; x representing all that part of the isolated acid not replaced by metal in neutralization. A few examples follow.

"*Sour Bodies.*

$H + Cl$	= Hydrochloric	Acid.
$H + I$	= Hydroiodic	"
$H + Br$	= Hydrobromic	"
$H + F$	= Hydrofluoric	"
$H + Cy$	= Prussic	"

$$\begin{array}{lll}
H + SO_3 & = \text{Sulphurous Acid.} & \\
H + SO_4 & = \text{Sulphuric} & \text{"} \\
H + NO_6 & = \text{Nitric} & \text{"} \\
H + C_2 H O_4 & = \text{Formic} & \text{"} \\
H + C_2 O_4 & = \text{Oxalic} & \text{"} \\
H + C_4 H_3 O_4 & = \text{Acetic} & \text{"} \\
H + C_6 H_5 O_4 & = \text{Metacetonic} & \text{"} \\
H + C_8 H_7 O_4 & = \text{Butyric} & \text{"}
\end{array}$$

etc., etc.

"*Have sour bodies also a common form?*

"The interest which attaches to the above formulæ will not be diminished by the consideration, that many ***bitter bodies***, such as aloes, assafœtida, myrrh, and the resins in general, have a constitution referable to a single fundamental type. Heldt, in a recent elaborate paper, in Liebig's *Annalen*, upon Santonine and the formation of resins from essential oils, gives several probable modes of production, which may be expressed in the following formulæ. It will be seen that the constitution is such that a certain amount of Hydrogen may be oxidated without the oxidation of the carbon. The general conception of Heldt has been long entertained by chemists, but has, in his paper, for the first time, met with a full exposition.

"*Bitter Bodies.*

$$[C_{10} H_8]^n - H_x + O_x = R.$$
$$[C_{10} H_8]^n - H_x + O_x + [H O]_y = R.$$
$$[C_{10} H_8]^n - H_x + O_x + O_y = R.$$
$$[C_{10} H_8]^n - H_x + O_x + O_y + [H O]_z = R.$$
$$[C_{10} H_8]^n + [H O]_x = R.\text{"}$$

Professor Peirce communicated the following elements of the "Orbit of Flora, computed at Göttingen, from normal places Oct. 22.5, Nov. 20.5, and Dec. 19.5," by Benjamin Apthorp Gould, Jr., A. A. S.

"Epoch 1848, Jan. 1.0, Berlin Mean Time.

	°	′	″	
Mean Anomaly	35	53	31.98	
Long. Perihelion	32	52	1.7	Mean Equinox.
Long. Asc. Node	110	18	50.8	Mean Equinox.
Inclination	5	52	55.9	

Log. mean daily sid. mot.	3.0358738
Log. eccentricity	9.1956181
Log. semiaxis major	0.3427552
Time of revolution	1193¼ sidereal days.

"The following are the results of the comparison of this orbit with observation: —

Calculated *minus* Observed.

Date.	Right Ascension.				Declination.			
	Altona.	Berlin.	Hamburg.	Cambridge.	Altona.	Berlin.	Hamburg.	Cambridge.
1847, Oct. 21,				+ 1.″9				0.″0
22,	— 0.″7				— 0.″1			
25,	— 1.2	— 0.″8	+ 1.″5		+ 0.7	+ 3.″7	+ 1.″7	
26,	— 0.4				+ 0.5			
31,	— 0.3		+ 1.8		+ 0.1		— 2.8	
Nov. 1,		+ 1.2				+ 1.5		
2,		+ 2.0				+ 0.3		
8,	+ 1.5	+ 3.9	+ 6.9		+ 1.4	+ 1.7	+ 2.0	
9,			+ 4.1				+ 0.4	
10,	+ 0.4		+ 2.8		+ 2.1		— 1.6	
11,		+ 2.8				— 0.1		
12,		— 0.4	+ 1.9			+ 2.7	+ 0.3	
16,			+ 3.1				+ 2.2	
17,	+ 0.7	+ 0.7	+ 3.5		+ 0.7	+ 1.6	— 1.7	
18,	+ 0.6	+ 1.4	+ 3.8		— 2.5	+ 2.2	— 0.7	
21,			+ 1.2				+ 0.1	
22,			+ 1.9				+ 1.6	
24,	— 0.6	— 0.5	+ 1.2		+ 3.4	+ 1.6	+ 0.3	
25,		+ 0.2				+ 1.8		
27,	— 0.1	+ 1.7	+ 1.8		+ 2.1	+ 1.3	+ 1.1	
28,	+ 0.1		+ 4.8		— 2.3		+ 0.8	
Dec. 1,	+ 0.8				+ 4.3			
4,	+ 0.4		— 0.8		+ 2.1		+ 2.5	
				Göttingen.				Göttingen.
7,		+ 3.6	+ 1.1			+ 0.8	+ 1.0	
8,			+ 3.0				+ 2.9	
10,				+ 1.″5				+ 5.″0
11,				— 0.7				+ 3.4
12,				+ 0.9				+ 3.4
								Transit I.
17,				— 0.5				
18,			+ 5.1	— 0.4			— 0.1	
19,			— 1.2				+ 1.9	
20,			+ 4 9				+ 1.2	
1848, Jan. 3,				+ 9.6				+ 4.7
5,				+ 7.0				+ 6.1

Three hundred and sixth Meeting.

March 7, 1848. — MONTHLY MEETING.

The PRESIDENT in the Chair.

The Corresponding Secretary read letters of acceptance from the Hon. Capt. W. H. Smyth, President of the Astronomical Society of London, and from Professor Spencer F. Baird, of Carlisle College.

Dr. M. Wyman, from the Committee, appointed at the October meeting, to make experiments for testing the value of the principal kinds of ventilating apparatus now in use, made a report, of which the following is an abstract.

"The apparatus used in most of the following experiments consists, 1st, of a machine for producing and maintaining a constant and equable blast of air; 2d, of an arrangement for measuring the velocity of the current produced by this blast.

"The air is put in motion by means of a revolving fan of four blades or vanes, each 21 inches long by 10 inches wide, placed upon the extremities of radii 13 inches in length. These blades revolve within a cylindrical case, nearly concentric with the axis of the blades, to which the air gains admission by two circular openings 13 inches in diameter, one in either end of the case. From one side of this case, the air, put in motion by the blades, enters a trunk 3 feet in length, and at its commencement 21 inches wide by 18 inches deep, which is gradually contracted until, at its farther extremity, its cross section becomes a square of 100 inches area. To the mouth of this trunk another is fitted, also 10 inches by the side and 3 feet in length. This last was added to avoid any interfering or unequal currents which might be produced by the converging sides of the first. Upon the axis of the blades is fixed a pinion of sixteen leaves, which engages a wheel of eighty teeth, driven by a handle; consequently the blades revolve with five times the velocity of the handle, or 300 times per minute when the handle makes one revolution per second. This is the velocity always used in the following experiments, unless otherwise stated.

"To measure the velocity of the blast, a toy marble, .62 inch in diameter, is suspended by a silken thread, to which it is fastened by a little sealing-wax. This thread is 3 feet in length, and the point of

suspension, over the mouth of the trunk, is such that the marble hangs as nearly as possible in its centre. The handle is made to revolve accurately once a second, and the deflection of the marble from the point of rest, under the influence of the blast thus produced, observed. The marble is then protected from the blast, and the effect of the blast upon the thread alone observed and deducted from the first result. To ascertain the value of this deflection, the following method is adopted. Into a large cylindrical vessel, filled with water, a pipe, an inch in diameter and bent into the form of an inverted syphon, is so placed, that, while one of its branches rises in the centre of the vessel, an inch above the surface of the water, the other branch rises along the side of the vessel, over which it is bent nearly horizontally. Another and similar vessel 15.5 inches in diameter at the top, 14 inches at the bottom, and 8.25 inches in depth, is inverted upon the surface of the water in the first. By pressing down this second vessel the contained air is made to issue from the open extremity of the pipe; and as the areas of the vessel and pipe are both known, we have but to note the time required to empty the second vessel to learn the velocity of the escaping air. The marble is now suspended by the same thread; the point of suspension being so situated that the marble falls against the mouth of the pipe, and would, if allowed to move freely, hang as far within it as the marble, deducting the effect upon the thread, was deflected by the blast. The second vessel is now depressed with such velocity that the marble is just made to swing clear of the mouth of the pipe, by which its deflection becomes precisely that produced by the blast which is to be measured.

"In the case under consideration, the deflection of the thread and marble together was 2.5 inches; that dependent upon the thread alone, .95 inch. The time occupied in depressing the vessel until it rested upon the top of the inverted syphon, in several successive experiments, was 12.25 seconds. The contained air was compressed .25 inch to produce this velocity, and, as the pipe rose 1 inch above the surface of the water, 1.25 inches were deducted from the depth of the vessel, leaving an available depth of 7 inches. The mean diameter, that at the top being 15.5 inches, and at the bottom 14 inches, is 14.75 inches. As the areas of circles are to each other as the squares of their diameters, we have these areas in the proportion of 217.56 to 1. This number multiplied by the depth in inches, 7, gives the whole expenditure in 12.25 seconds, the time required to empty the vessel; from which

we obtain a velocity of 124.32 inches, or 10.36 feet, per second,— 7.06 miles per hour. This, therefore, may be assumed as a near approximation to the velocity of the blast, when not otherwise mentioned.

"The velocity of the induced current being the true measure of the practical value of different forms of ventilating apparatus, it becomes necessary to ascertain this value as accurately as possible. The inconvenience attending measurements in which time is involved as one of the elements, and also, probably, the difficulty of determining the instant when a current has passed through a certain space, have led to the adoption of other means, by which the velocity of the current is not directly measured, but inferred. The mode which has been repeatedly adopted, of measuring the efficiency of a ventilator by its power of sustaining a weighted flap or valve, or a head of water, or by some other statical effect, is decidedly objectionable. Such a measure gives the correct value of the initial force or tendency to establish a current in a chimney in which there is no actual movement; but it does not indicate the velocity of the current which will be the final result of the action of the ventilator, nor is it any measure of this final velocity when ventilators of different construction are compared together. Mechanics and engineers are familiar with the difference between the statical and dynamical effects of a force. They are aware that the former may be greatly increased by the mechanical powers, so that, through the medium of a pulley or a lever, a single pound may be made to sustain and raise a hundred times its own weight. But the dynamical effect is not correspondingly increased, for in order to raise one hundred pounds through the height of a foot, the one pound must in all cases fall one hundred feet; so that the loss of height precisely balances the gain in weight. In the same way, the dynamical effect of different springs is not to be measured by their strength alone; it is not simply dependent upon the amount of weight which they will sustain, but equally upon their length, or rather upon the distance through which they move in restoring themselves to equilibrium. The archer's bow is a good instance of this assertion, which any one can try for himself, and he will find, that, with a given exertion of strength, he is able to throw the arrow farthest and highest with that long bow of which he can draw the string to his full arm's length, and not with the strong bow which he can hardly move. But an example more nearly allied to the case under consideration is derived from the air-pump, in which the dynamical value of any amount of exhaustion is equal to

the power required to produce it, and is, therefore, proportioned to the magnitude of the receiver when other circumstances are the same; whereas its statical power or its power to sustain a head of water is wholly independent of the magnitude of the receiver, and proportioned solely to the tension of the air within it. In all these cases, there is a striking difference between the operations of using the statical and dynamical effects, which deserves the most careful consideration, because it is essential and characteristic. The statical effect may be used for any length of time without being impaired, and the reason is obvious; it manifests itself in a state of rest, when there is no change of condition. The dynamical, on the contrary, can be used once and but once. The one pound can balance the hundred pounds as long as the materials of the pulley and lever will endure; a compressed spring may sustain its weight, or the expanded air its head of water, as long as we choose, without any diminution of effect. But when work is to be done, a change to be effected, a weight to be raised, a velocity to be produced, the result can only be obtained by a corresponding change in the opposite direction, an undoing of work, a falling of a weight, a consumption of power once and for ever. In the present case, in which the object is to obstruct or divert the motion of the wind in such a way that part of its velocity may be communicated to the air in the chimney, and thus produce a current, the amount of this communication and transfer of velocity cannot be measured when it does not take place, — when, on the contrary, the mouth of the chimney is entirely stopped up, so that it is impossible to produce any current within it. It would be just as proper to weigh a water-wheel by the weight which will just reduce it to a state of rest, instead of that smaller weight which reduces it to its usual working velocity, and which is universally adopted by experienced engineers as the correct measure of the power of the wheel. It should also be borne in mind, that there are resistances offered to air in motion by the tube through which it passes. These resistances are not constant; they increase as the perimeter and length of the tube directly, and also as the square of the velocity; these, it is obvious, cannot be measured where they do not exist.

"The plan, therefore, which has been adopted in these experiments, is to measure directly the velocity of the current produced, and it will not be surprising, after what has preceded, if some striking differences should be observed between the results thus obtained and those derived from any statical measure.

"To measure the current, a leaden pipe (the material most readily at hand), 1.25 inches in diameter and 53 feet in length, is placed near and a few inches below the mouth of the blowing-machine. This pipe is coiled, as it leaves the manufactory, into a circle of about 2.5 feet in diameter, of which it makes eight turns. In the mouth of the trunk, before described as attached to the blowing-machine, is a tube of tinned iron, of the same diameter as the pipe, and bent at a right angle; the upright branch, about six inches long, reaching to the middle of the mouth, while the horizontal portion, about five inches in length, reaches within 2.5 inches of the end of the leaden pipe. Each ventilator, when examined and tested, is placed upon the upright portion of this tube. For this purpose the ventilator has through it, or attached to its side, a corresponding tube of the same diameter. The connection between these two tubes is completed by a glass tube 4 inches long and 2 inches in diameter, and the fitting made close by means of cotton-wool fastened loosely around the extremities of the two metallic pipes. In this compound pipe the current is induced, and its velocity noted. To effect this last object, advantage is taken of the well-known action of iodine upon starch.* Iodide of potassium is dissolved in a strong solution of starch in hot water, in the proportion of three grains or more of the iodide to an ounce of the solution. A piece of paper wetted, or rather smeared, with the prepared starch is suspended within the glass tube, which can be readily removed for this purpose, by means of a wire hook attached to the metallic pipe. A current is now induced by the action of the blast upon the ventilator, and chlorine gas allowed to enter the opposite end of the pipe, which is kept carefully removed from the influence of the blast. The chlorine is carried along with the current until it reaches the starched paper, which it instantly dyes a deep blue; the chlorine, by its superior affinity for the potassium, seizing upon it, and leaving the iodine free to act upon the starch.

"Chlorine is conveniently obtained for this purpose from Labarraque's solution of chloride of soda, and its liberation quickened, if need be, by adding a few drops of sulphuric acid. When the vial containing the chlorine is closed by the finger, and held a few seconds in the

* The action of hydrosulphuric acid upon moist carbonate of the oxide of lead was first suggested for this purpose, but the chlorine and iodide were judged most convenient.

hand, its warmth expels the gas more freely, and when the finger is removed it escapes in a jet, which makes the experiment more decisive.

"In making the following experiments three persons were usually employed; one to keep up a uniform blast, counting the revolutions of the handle by a watch; a second to throw the chlorine into the pipe, and also to observe and declare the moment when the blue color appears upon the starched paper; the third to note upon a watch the interval between these two events.

"RESULTS OF EXPERIMENTS.

"1. Air in motion communicates motion to those portions of air at rest in its immediate vicinity. To this phenomenon Venturi, who discovered and explained it, has given the name of the lateral communication of motion in fluids.

"2. A jet of air falling upon any surface is never reflected, but spreads itself out, and forms a thin layer in immediate contact with that surface. It may be admitted as a principle, that fluids do not, under any velocity or any angle of incidence, possess the property of reflection, like solids, and it is, doubtless, owing to the absence of this property that they adhere to bodies against which they strike. In virtue of this adhesion, a jet of fluid striking a sphere perpendicularly to its surface spreads itself uniformly over both the superior and inferior hemispheres; a similar jet striking a horizontal cylinder perpendicularly to its surface completely surrounds it, and does not leave it until the two parts of the jet meet on its inferior border and form one common sheet. (Savart, *Annales de Chimie et de Physique*, Tom. LIV.)

"When a jet of water strikes a truncated cone perpendicularly to its axis, and just above its lower base, it spreads out, covering more than half its surface, and, rising upward, leaves its upper base in a continuous sheet, vertically in a plane nearly coinciding in direction with that of the sides of the cone, and horizontally nearly in the direction of tangents to the surface of the cone, while a small portion only of the fluid forms two small streams, which drop down from those two points of the lower base of the cone which are at right angles with the original direction of the jet.

"When a jet meets a circular plane at its centre and perpendicularly, it forms a thin continuous sheet over the whole surface. Both the direction and continuity of this sheet are preserved far beyond the

borders of the circular plane, where its edge is thin, but it follows more or less the direction of the curve of the edge, if it is thick and rounded.* (Savart, *Ann. de Chim. et de Physique*, Tom. LIV. p. 119.)

"3. When a jet of air impinges upon a surface of limited extent, the atmospheric pressure upon the opposite side of the surface, in consequence of the lateral communication of motion, is diminished, and a current will be established through a tube, one of the extremities of which is placed in the point of diminished pressure, and the other beyond the borders of the surface. This is the important principle upon which the efficiency of ventilators and chimney-tops depends; it is also important in its bearing on the position of the mouths of air-trunks for hot-air furnaces; if the mouth be placed in a point of diminished pressure, on the leeward side of a building, air may pass outward, especially from apartments on the windward side of the house.

"4. When a current strikes the extremity of a tube perpendicularly to its axis, motion is produced through the tube towards the current; and when a current already exists in the tube, if its velocity is less than that of the impinging current, that velocity will be increased.

"When two currents of air of different velocities are moving in precisely the same direction, the influence of the more rapid current in accelerating that which is less rapid is not so great as when the angle of meeting is between 20° and 40°. When two opposite currents of equal diameter and velocity meet, they form a circular sheet, perpendicular to the axis of the veins, and the resulting phenomena resemble those arising when a current strikes a circular plane. If the ve-

* A simple demonstration of these propositions may be obtained by means of a card and candle. If a blast from the mouth be directed obliquely against a card, the flame of a lighted candle will be drawn towards the card, on whatever side of it the candle is held. Increasing or diminishing the velocity of the blast does not change the direction assumed by the flame, but only the velocity with which it is drawn towards the card.

If the blast be directed perpendicularly upon the centre of the card, the flame, when passed around the edge of the card, will be driven outward at all points; and if the candle be held near the blast, and at a little distance from the plane surface, the flame will, in virtue of the lateral communication of motion, be drawn towards the surface, and yet by the current of air close to and parallel with the card it will be prevented from reaching it. A strong flame may thus be made to play, apparently with great force, upon the hand, and yet not burn it. An illustration of this principle may often be observed in the narrow pathway, so convenient for foot-passengers, found after a snow-storm, on the windward side of a high and close fence.

locities of the currents are unequal, the greater velocity diminishes the less, destroys it, or inverts it, according to the excess of velocity. The knowledge of this fact leads at once to the interposition of a plate, to prevent loss of velocity in interfering currents.

"5. A thin plate placed upon the extremity of a tube, at the proper angle, causes the impinging current to assume a certain direction, and to produce a certain velocity in the tube; a similar plate parallel to and above this plate does not increase that velocity.

"A cone placed upon the extremity of a tube produces similar changes of direction in the impinging current, and similar movements in the tube, but another cone above the first does not increase the velocity of those movements.

"6. Beyond certain narrow limits, the velocity produced in a tube by the action of a current on its conical extremity is not increased by increasing the height or diameter of that cone. The full effect of a cone may be obtained when its lower base is not larger than one half, nor less than one third, the diameter of the flue on which it is placed.

"7. If a flat truncated cone be fitted to the extremity of a tube, and exposed to the impinging current, a velocity may be produced in the tube of 1.71 feet per second; if a similar but much smaller hollow truncated cone be inverted and closely secured to the mouth of the first, the velocity in the same tube may by this means be increased to 2.21 feet per second. The same increase of velocity will be produced if the internal cylindrical bore of the first cone be made conical, with its larger base upward. By the addition of this secondary cone, or by the modification of the interior of the first cone, the velocity of the current is increased over that produced by the simple cone nearly in the ratio of 10 to 13, and as the effect is as the square of the velocity, its efficiency is increased nearly in the ratio of 10 to 17. This is the best form of the simple fixed cone, and *the most efficient fixed ventilator*, which has been examined by the Committee. Venturi has shown, that, when a conical tube is applied to a cylindrical pipe, the larger base of this conical tube being 1.8 the diameter of the pipe, and its height 9 times the diameter of this same pipe, the expenditure will, with water, be greater for the cone than for the cylindrical pipe, in the proportion of 24 to 12.1.

"8. A hollow truncated cone, with its larger base closed by a flat plate, inverted and placed above a cone similar to that last described, will increase the velocity of the current in the pipe upon which it is

placed over that produced by a simple cone nearly in the ratio of 10 to 13. This is one of *the most efficient fixed ventilators with a cap* which have been examined by the Committee. The form described in the preceding paragraph, with Cisalpin's plate placed at a certain height above it, is to be ranked in efficiency with that last described.

"9. The velocity of the current produced in a pipe, the mouth of which is presented fairly to the blast, is nearly constant, whether the mouth be cylindrical, conical, with its larger base towards the blast, or the reverse. The diminished area exposed to the blast, in the latter case, is counterbalanced by the increased velocity consequent upon diminished atmospheric pressure within the cone.

"10. A difference of temperature between the impinging blast and the produced current does not, within the limits observed, influence the velocity of the latter.

"EXPERIMENTS.

"In the experiments, each ventilator, when examined, is placed upon a perpendicular *fixed tube* of tinned iron, in the centre of the mouth of the trunk of the blowing machine. This and all other tubes, when not otherwise mentioned, are 1.25 inches in diameter. The velocity of the blast is 10.36 feet per second, or, as indicated by the revolutions of the handle of the blowing-machine, one revolution per second. The time required for the chlorine to act upon the starch, from the moment it is introduced into the pipe, is given in seconds; the velocity of the current is given in feet and decimals. The direction of the blast is indicated by the →.

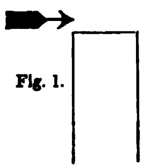
Fig. 1.


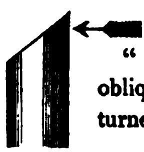
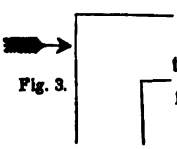
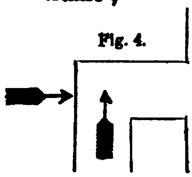
Fig. 2.


Fig. 3.


	Time in Seconds.	Velocity per Second. Feet.
"*Experiment* 1. Perpendicular fixed tube, ...	73.2	0.728
"*Exp.* 2. Straight tube, cut off obliquely at an angle of 45°; opening turned from the blast, ...	40.0	1.325
"*Exp.* 3. Elbow; horizontal portion one inch long, opening turned from the blast, ...	72.0	0.736

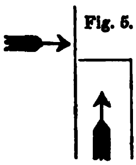
	Time in Seconds.	Velocity per Second. Feet.
" *Exp.* 4. Elbow; horizontal portion 4 inches long, opening turned from the blast, ...	70.0	0.757
" *Exp.* 5. Same; horizontal portion making, with the direction of the blast, an angle of 30°, . .	46.0	1.152
"Same; angle of direction 45°, . . .	41.0	1.290
"Same; " " 60°, . . .	43.0	1.233
"Same; " " 90°, . . .	64.0	0.828

Fig. 4.



" *Exp.* 6. Elbow turned from the blast, and having around its opening a plane surface 1.5 inches wide, ...	31.0	1.71

Fig. 5.



" *Exp.* 7. A perpendicular plate 2 inches wide and 1.75 inches in height, fastened to that side of the fixed tube next the blast, .	33.0	1.61
"Same plate attached to the fixed tube, but with its edges in the same direction with the blast, ...	48.0	1.05
"Same plate on the side of the fixed tube, opposite the blast, ... no effect in	180.0	
" *Exp.* 8. A square plate, 2 inches by the side, on the top of the fixed tube on the side next the blast, .	31.5	1.68
"Same plate making with horizon an angle of 80°,	28.2	1.87
" " " 75°,	27.3	1.94
" " " 70°,	29.0	1.83
" " " 67°,	28.7	1.85
" " " 45°,	39.0	1.36
" " " 22°,	65.0	0.791
" *Exp.* 9. Square plate, 2 inches by the side, with vertical edges .5 inch wide, turned from the blast, and making an angle of 45° with its direction; the whole plate making an angle of 75° with the horizon, .	31.0	1.71
"Same plate, making same angle with the horizon, but with its edges turned in the opposite direction; that is, towards the blast, ...	24.6	2.15

" *Exp.* 10. A plate 1.25 inches wide at the base, 2

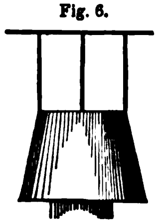
	Time in Seconds.	Velocity per Second.
inches wide at top, and 2 inches high, with its edges turned towards the blast, as in the last experiment, gave very nearly the same results, ...	24.7	Feet. 2.14
" *Exp.* 11. A plate 2 inches wide at the base, 1.25 wide at the top, and 1.5 inches high; angles of sides with base equal to inclination of the plate with the horizon, 76°; placed on the top of the fixed tube, on the side next the blast, its base being raised .37 inch above the mouth of the fixed tube, ...	29.5	1.80
" A similar plate added to the opposite side of the tube, ...	28.5	1.86
" Similar plates on three sides; open side from the blast, ...	33.5	1.58
" Similar plates on three sides; open side at right angle with direction of the blast, ...	32.2	1.65
" Similar plates on four sides, ...	35.4	1.494
" *Exp.* 12. Pyramid formed by the four plates, as last arranged, with its base so fitted to the top of the fixed tube that no air could enter by its side, . .	35.5	1.49
" *Exp.* 13. Two similar plates, those used in the last experiments, one arranged as in Exp. 10, and the other similarly placed, but raised .37 inch above the first, ...	29.0	1.83

" The influence of the inclined plate, used in several of the preceding experiments, would at once suggest the application of a figure of revolution, which would have a similar effect upon the blast, that is, would direct it upward, and thus assist the escape of the current from the tube. A cone is evidently one form which would have this effect. Indeed, the conical chimney-top has been long in use, and its principle often reproduced under slight modifications of form.

" The cone was proposed as a proper form for the chimney-top, and an account of its application published, more than seventy years ago, by Count Cisalpin, in a memoir entitled *Description d'une Cheminée et Étuve de Nouvelle Invention.* The plan contrived by Cisalpin consisted of truncated cones of plate or sheet iron, of different sizes. 'When this apparatus is to be used,' says he, 'fit to your chimney your first size; it is of no consequence whether the chimney be round

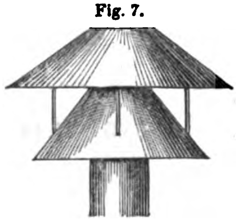
or square, provided it have no holes in its sides, and is open only at the top; if this put a stop to the smoking, your object is probably accomplished, the equilibrium between the wind and smoke is destroyed (nevertheless assure yourself of this by many experiments, made at different times), and then you have nothing further to do than to attach to three sides of the cone three rods of iron, four, five, or six inches long, on which place horizontally a round plate, having a diameter a little larger than that of the cone, to prevent the rain from entering the chimney.' The adjoining figure is an elevation from the perspective view given in the memoir.

Fig. 6.



"In 1788, De Lyle de Saint-Martin, a lieutenant in the French navy, again called attention to this form of chimney-top, in a memoir, giving a full description, with drawings, of its construction, and the results of his experiments. The cap surmounting the cone, instead of being flat as in Cisalpin's, was also a truncated cone, but differing in its proportions from that forming the chimney-top. This arrangement, which is here figured from Saint Martin's memoir, was examined and approved by the French Academy of Sciences, and published in its Transactions.

Fig. 7.

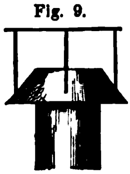


"Mr. Tredgold, in his treatise on Warming and Ventilating Buildings, published in 1824, and still a standard work, refers to the conical top as one which may often be employed with advantage, when formed in the manner described in fig. 8; and remarks, — 'The upper cap prevents down blasts of air, but in a steady horizontal wind the lower cone alone would be sufficient.' Its mode of action is described and illustrated by figures, from one of which the annexed cut is copied. For its origin Mr. Tredgold refers to the memoir of De Lyle de Saint-Martin. It will be noticed that the conical cap has, in the last figure, assumed the spherical form.

Fig. 8.

"The annexed cut shows the same truncated cone, which has, during the past year, been introduced as quite a novelty, the inventor having gone back to first principles, and again mounted the flat top.

Fig. 9.

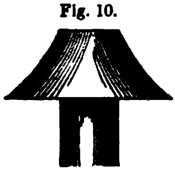


"It is quite probable, that the conical and pyramidal earthen and brick chimney-tops now and for many years so generally used are modifications of those introduced or recommended by Cisalpin, Saint-Martin, and Tredgold.

	Time in Seconds.	Velocity per Second. Feet.
"*Exp.* 14. A truncated cone, diameter of upper surface 1.25 inches; diameter of lower surface 4.3 inches; height 1.3 inches; lower surface upon fixed tube; upper surface in centre of trunk, . . .	31.0	1.71
"*Exp.* 15. Same cone divided into three cones of equal height by planes parallel to the two surfaces; two smaller cones, ...	31.0	1.71
"Smallest cone, ...	31.5	1.68
"*Exp.* 16. Truncated cone, diameter of lower surface 2.1 inches; height .35 inch; diameter of flue and upper surface, as usual, 1.25 inches, . .	31.0	1.71

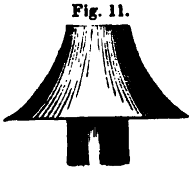
"Inclination of sides to base, in these last cones, the same; 40°.

Fig. 10.



"*Exp.* 17. Cone; angle of side with base, at bottom 47°, at top 55°, side concave; diameter of base, 3.7 inches; height, 1.4 inches, ...	35.4	1.49

Fig. 11.



"*Exp.* 18. Cone; angle of side with base, at bottom 44°, at top 64°, side concave; base 4 inches in diameter; height 1.9 inches,	37.6	1.41
"*Exp.* 19. Cone, with its cap, made according to the proportions laid down by Saint-Martin (see fig. 7),	34.0	1.56
"*Exp.* 20.* Cone and plate; inclination of sides to base 45°; diameter of base 2.9 inches; height .83 inch (see fig. 9), ...	33.5	1.58

* Dimensions of cone and plate, from which this model was made, as follow: — diameter of flue 18 inches; base of cone 3ft. 6in.; height of cone 12in.; diameter of plate 3ft. 6in.; height of plate above top of cone 9in.; thickness of plate 1¼in.

	Time in Seconds.	Velocity per Second.
		Feet.
"*Exp.* 21.* Cone and plate similar to last; base 2.5 inches in diameter; height .62 inch; inclination of side to base 45° (see fig. 9), ...	33.0	1.61
"Same cone without plate, ...	31.0	1.71
"*Exp.* 22. Saint-Martin's cone without the cap; to the upper surface and around the opening a hollow truncated cone is fitted; height .62 inch; angle of sides 42°; larger base of the frustum upward, .	24.0	2.21
"*Exp.* 23. Cone used in Exp. 21, with a hollow truncated cone, .37 inch high, and angle of sides 42°, fitted as in last experiment, ...	24.5	2.16
"*Exp.* 24. Cone; angle of sides with base 48°; with hollow truncated cone, as in last experiment, .	25.0	2.12
"*Exp.* 25. Cone; diameter of lower base 2.5 inches; diameter of upper base 1.6 inches; height .55 inch; internal diameter at lower base 1.25 inches, and diverging to 1.6 inches at upper base, . . .	25.5	2.08
"*Exp.* 26. Cone similar to that used in Exp. 21, with a flat plate, as recommended by Cisalpin (see fig. 6), .7 inch above top of cone; diameter equal to that of base of cone; on under surface of the plate a hollow cone .37 inch in height, lesser base downwards,	25.0	2.12
"*Exp.* 27. Square block representing a chimney; flue $1\frac{1}{4}$ inches in diameter; sides 2 inches; height 4 inches; one side towards the blast, ...	33.5	1.57
"Same, with corner towards the blast, . . .	35.5	1.49
"Same, with a small cone .5 inch high; angle of side 63°; side to the blast, ...	37.5	1.425
"*Exp.* 28. Same block, with its plane upper surface inclined towards the blast, at an angle of 3° with the horizon, ...	37.0	1.43
"Same, at an angle of 10° with horizon, . . .	39.0	1.36
" " " 20° " " . . .	87.0	0.609

* Dimensions of the original of this model: — diameter of flue 8 inches; diameter of cone at base 16 inches; height 4 inches; diameter of plate 16 inches, and 4 inches above top of cone.

	Time in Seconds.	Velocity per Second.
		Feet.
"*Exp.* 29. Same block; upper surface horizontal; a square plate, 2 inches by the side, on that side which is next the blast, ...	34.0	1.56
"*Exp.* 30. Conical tube, open at both extremities; diameter of larger opening 2 inches; of lesser extremity 1.3 inches; length 4 inches; inclination of sides 5°; centre of lateral opening 1.6 inches from lesser extremity; lesser extremity turned towards the blast, ...	35.0	1.51
"Same conical tube; lesser opening reduced to .37 inch, ...	54.0	0.981
"*Exp.* 31. Conical tube, open at both extremities; diameter of larger 3 inches; of lesser 1.25 inches; inclination of sides 15°; length 7 inches; centre of lateral opening 1.7 inches from lesser end; lesser end towards the blast, ...	28.4	1.87
"*Exp.* 32. Same conical tube, its sides continued until they form a cone, with its apex turned toward the blast, ...	51.0	1.039
"Same, with its axis making, horizontally, an angle of 35° with the direction of the blast, . . .	31.0	1.71
"Same; axis making an angle of 15° with the blast,	30.0	1.77
" " " 7° " "	27.0	1.96
"*Exp.* 33. Conical tube; angle of sides 47°, open at both extremities; diameter of larger extremity 4 inches, of lesser 1.4 inches; length 3.3 inches; centre of lateral opening from lesser end 1.1 inches, .	36.5	1.45
"Same tube; sides prolonged, forming a cone; apex towards the blast, ...	32.5	1.63

Fig. 12.

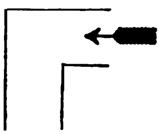
Fig. 13.

"*Exp.* 34. Conical tube; inclination of sides 90°; larger end 4 inches, lesser 1.25; height 1.3 inches (fig. 12), .	28.5	1.86
"Same; sides prolonged, forming a cone; apex to the blast (fig. 13), ...	34.0	1.56.

	Time in Seconds.	Velocity per Second. Feet.
" *Exp.* 35. Revolving conical ventilator, according to the proportions of the inventor, . . .	41.0	1.29

"In the following experiments on the velocity of currents through the same length of leaden pipe, the current was produced by the same blast acting upon mouth-pieces of different forms and dimensions, applied to the leaden tube and presented fairly to the blast.

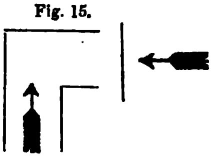
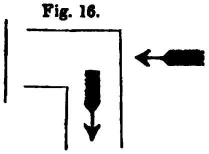
Fig. 14.



" *Exp.* 36. Elbow, opening turned towards the blast; current traversed leaden pipe in	19.0	2.706
" *Exp.* 37. Conical tube, Exp. 30, closed at lesser end, the other turned to the blast, ...	19.7	2.69
" *Exp.* 38. Conical tube, Exp. 31, closed at lesser end, the other turned to the blast, ...	18.6	2.85
" *Exp.* 39. Conical tube, Exp. 33, closed at lesser end, the other turned towards the blast, ...	16.0	3.31
" *Exp.* 40. Conical tube, 2 inches long; diameter of larger extremity 1.25 inches; diameter of lesser .8 inch, which is presented to the blast, . . .	19.7	2.69

" *Exp.* 41. A glass tube, .25 inch bore, and long enough to reach from the centre of the trunk beyond its side, and, consequently, beyond the influence of the blast, was fastened by one of its extremities in a small hole bored for this purpose in the side of the conical tube used in the last experiment, and near its larger extremity. The conical tube was placed in the same position as before. On presenting the flame of a candle or any light substance near the open extremity of the glass tube, a current of air was perceived flowing into the tube.

" *Exp.* 42. Saint-Martin's cone and cap (see fig. 6), with its axis parallel with the blast; blast directly upon the top of the cap, ...	29.0	1.83
" *Exp.* 43. Cone of 45°, with flat plate (fig. 9), axis parallel with the blast, as in preceding experiment,	29.5	1.80

	Time in Seconds.	Velocity per Second.
Fig. 15.  "*Exp.* 44. Elbow with its mouth towards the blast, and covered by a flat plate, 3 inches in diameter and 1 inch from the mouth, ...	27.6	Feet. 1.92
Fig. 16.  "*Exp.* 45. Same elbow and plate, but turned in the opposite direction with reference to the blast; current passed down the pipe, and traversed it in . .	49.0	1.08
"Same elbow, with a curved plate 1.75 inches in diameter, .75 inch from the mouth of the elbow; mouth turned towards the blast, ...	36.0	1.45
"*Exp.* 46. Conical tube, 4 inches long; a plate 3 inches in diameter, and .75 inch distant from lesser extremity, plate turned towards the blast, . . .	38.0	1.40

"The experiments which follow are on the influence of ventilators upon a current already established, and moving with a certain velocity in the same direction with that produced by the ventilator. The current is established by placing the farther end of the leaden pipe — that which has heretofore been kept carefully beyond the influence of the blast — in the blast, in such a manner that it shall receive more or less of its force.

Velocity of established current in seconds, " " " feet,	29″ 1.83		15.5 3.42		26.5 2.00	
	″	ft.	″	ft.	″	ft.
Elbow with plate; plate towards the blast, .	19.7	2.69	14.5	3.66	18.3	2.89
Cone, fig. 9, without its plate, ...	26.5	2.00	17.2	3.08	. .	. .
Same, with its plate, ...	26.5	2.00	. .	. .	. .	. .
Saint-Martin's cone, ...	25.0	2.12	14.5	3.66	. .	. .
Saint-Martin's cone and cap, ...	26.2	2.02	. .	. .	26.0	2.04
Cone; angle of sides 71°; height 1.5 inches,	. .	. .	14.2	3.72	. .	. .
Conical tube, Exp. 31, lesser end to the blast,	. .	. .	15.0	3.53	21.7	2.46
Conical tube of 47°, lesser end to the blast,	. .	. .	14.5	3.66	16.5	3.21
Conical tube, Exp. 30, lesser end to the blast,	. .	. .	. .	. .	18.2	2.90
Conical cap; tube of 47°, lesser end closed and turned to the blast, ...	. .	. .	. .	. .	17.0	3.11
Conical tube; length 2 inches; diameter at smaller end 1.25; at larger, 2 inches, over which and 1 inch from it is a plate 2.5 inches in diameter, turned to the blast; smaller end in the leaden pipe, ...	. .	. .	. .	. .	20.5	2.58
Elbow; plate 1.75 inches in diameter; .5 inch from mouth of elbow; plate towards the blast,	. .	. .	. .	. .	20.0	2.65
Same, with plate .75 inch from mouth of elbow,	. .	. .	. .	. .	20.75	2.55
Same; plate 2.5 inches in diameter, 1 inch from elbow, ...	. .	. .	. .	. .	17.6	3.00

"The established current in the following experiments varied somewhat in the different experiments, but was constant during the same experiment; they cannot, therefore, be compared with each other without reference to the velocity of the established current.

	Established Current.		Current in Pipe.	
	"	ft.	"	ft.
Saint-Martin's cone and cap, ...	22.7	2.33	25.5	2.08
Same cone without cap, ...	22.2	2.39	26.5	2.00
Cone, fig. 9, with its plate, ...	25.5	2.08	27.0	1.96
Same cone without its plate, ...	23.7	2.27	27.0	1.96
Model of a chimney; 2 inches by the side; end flat and horizontal; 4 inches long, ...	26.0	2.04	18.7	2.83
Model of same dimensions; top bevelled; angle of sides with horizon 40°, ...	26.0	2.04	21.5	2.47
Same; angle of plane of top inclined towards the blast, at an angle of 15°, ...	26.0	2 04	21.7	2.44
Same; same inclination; .75 inch above top a plate 2.5 inch in diameter, ...	26.0	2.04	21.7	2 44
Same, without the plate; inclined towards the blast 20°,	26.0	2.04	22.6	2 34
Same; inclined towards the blast 30°, ...	26.0	2.04	29.6	1 79
Same, at same inclination; plate .75 inch above the top,	26.0	2.04	25 6	2 07
Chimney model, with flat top inclined towards the blast, at the same angle, 30°, ...	26.0	2.04	52.5	1.00
Model and inclination same; plate 3 inches in diameter, .75 inch above the top, ...	26.0	2.04	42.0	1.26
Conical revolving cap; angle of sides 47°, apex towards the blast, ...	24.4	2 17	17.8	2.97
Conical cap, fig. 12, ...	27.5	1.92	18.5	2.86
Similar cone, with opening at apex, 1.25 inches in diameter, fig. 13, ...	27.5	1.92	18.0	2.94
Conical revolving cap; angle of sides 47°; apex to blast,	27.2	1.94	21.2	2.50
Same, with opening at apex, 1.25 inches in diameter; apex to the blast, ...	27.2	1.94	20.0	2 65

"The current established in the pipe was raised in temperature above that of the impinging current or blast, by placing the pipe in a vessel of hot water. The current in the pipe assumed a temperature of 104°, while that of the blast was 64°.

	ft.	"
"Elbow with a plate .87 inch from its mouth and turned towards the blast; temperature of current 64°; velocity	2.08	25.5
"Same; temperature of current 104°, . . .	2.08	25.5

"Several other experiments were made, but the results coincided so nearly that they may be considered as identical.

"The proportions of those forms of ventilators which the Committee have found most efficient will be placed in the hands of manufacturers."

Mr. Bond communicated the results of some recent observations on the planet Jupiter, and on the nebulæ Herschel Nos. 1357 and 1376 and the great nebula of Orion, as follows: —

"On the 28th of January and 3d of February, we had excellent opportunities for examining both hemispheres of the planet Jupiter, as on both occasions the atmosphere was in a remarkably tranquil state, and the definition good.

"On the 28th of January, at $10^{h.} 30^{m.}$ Camb. m. s. t., nine belts were counted, including those covering the polar regions of the planet. The principal equatorial belt was of an even surface, and its edges were nearly parallel. The next north was very irregular, particularly on its northern side. The other belts bore a striking resemblance to cirrus clouds, when about subsiding into the elongated form of cirrostratus. At the same time, the shadows of two of the satellites, the first and third, were seen transiting the disk. The preceding of these shadows when drawing near the limb became less intensely black, and was elongated in a direction nearly parallel to the axis of rotation of Jupiter. The third satellite was seen at the same time on the disk, as a black spot, and was then taken for the shadow of another satellite. It was not until we had compared its place with the ephemeris given in the Nautical Almanac, that we became satisfied that it could not have been a shadow. It agreed, however, with the computed position of the third satellite. Early in the evening, the first and third satellites were observed approaching the primary on the following side. The first appeared to be the smallest. The ingress of the third was observed, and when about half on the disk, it looked like a mountain projection on the limb of Jupiter. Neither of the satellites, when entirely on the disk, was visible at that time. Further observation was interrupted until about the time of ingress of the shadow of the third satellite, the first internal contact of which was noted at $6^{h.} 41^{m.} 51^{s.}$ sidereal time at the Observatory, the definition being at the time exceedingly fine. We now saw three black spots. The preceding was the shadow of the first satellite, which was now off the disk; the next occupied the position of the third satellite; the last, near the following limb, was the shadow of the third satellite, very black, and larger than the satellite itself in the proportion of 5 to 3.

"On the 3d of February, at $9^{h.} 30^{m.}$ m. s. t., the opposite hemisphere was presented under equally favorable circumstances. Three belts

only were seen. The broad one, lying a little south of the equator, had no longer its sides parallel, as on the 28th of January, but a deep hollow on its southern edge, reaching nearly across on the preceding side. The principal northern belt was much broken and diversified with dark spots and inequalities. But the most remarkable feature was a curdling appearance of the whole intervals between the belts, and also of the entire region about the south pole.

"On the morning of the 2d of February, we had a good view of nebulæ Herschel Nos. 1357 and 1376. Sir John Herschel's drawings, given in the Philosophical Transactions of 1833, are faithful representations of the wonderful phenomenon which they present. The great nebula in Andromeda shows a similar structure, but on a much larger scale. A fourth, which we find to possess the same peculiarity, is *h* 859, A.R. $11^{h.}$ $11^{m.}$, Dec. $+14° 30'$; it resembles *h* 1357, but is fainter.

"We find the great nebula of Orion to be connected with those about C and ι Orionis. Sir John Herschel's No. 75 in his Cape Catalogue of the stars in the nebula of Orion, which has heretofore been recorded as a single star of the eighteenth magnitude, is a double star. The direction of a line joining the components passes near θ^1; the distance is estimated at two seconds. No. 91 of the same catalogue has been hitherto taken for a single star of the seventeenth magnitude. This likewise is double, and the direction towards θ^1 of the Trapezium, and the distance estimated at two seconds. The following one of this pair is as precisely as possible on the following edge of the bright part of the nebula, at the bottom of the Sinus Magnus."

A communication was read from Mr. G. P. Bond, respecting the great nebula in Andromeda; the object of which was to direct the attention of astronomers to a remarkable peculiarity in its structure, which appears to have hitherto escaped notice. The paper was accompanied by a drawing, taken from repeated examination with the twenty-three-foot refractor of the Cambridge Observatory. Among the results of the employment of increased optical power upon this nebula has been the union with it of several neighbouring nebulæ, which have hitherto been regarded as distinct bodies. This paper was referred for detailed publication in the current volume of the Memoirs.

Three hundred and seventh Meeting.

April 4, 1848. — MONTHLY MEETING.

The PRESIDENT in the chair.

Mr. Bond communicated a farther notice respecting the third satellite of Jupiter, as follows: —

"In my communication of the 5th of February, I gave some account of a remarkable change which took place in the appearance of the third satellite of Jupiter, while transiting his disk on the evening of January 28th. I am now enabled, from subsequent observation, to confirm in a more detailed manner the account then given.

"During the evening of March 11th, this satellite was again seen as a *black* spot upon the disk of the primary; but as several visitors were present at the Observatory, the observations were discontinued. It was remarked, however, that the spot was of less magnitude than the shadow which subsequently passed the disk.

"On the 18th of March, we were more fortunate. The state of the atmosphere proving favorable, I watched, with my son, the entire transit. The following are the results of our observations.

"At $8^{h.}$ $15^{m.}$ sidereal time of the Observatory, we commenced, by estimating independently the relative order of brightness of the satellites; it was, — first, third, second, fourth.

"The third satellite, when close to the limb of Jupiter, suffered no diminution of its brightness or apparent magnitude.

"At the first contact with the primary, the latter seemed to recede from the satellite.

"At $8^{h.}$ $51^{m.}$, the contact of the centre of the satellite with the limb of Jupiter took place.

"$8^{h.}$ $55^{m.}$. First internal contact; the satellite was then seen distinctly on the disk, *brighter* than Jupiter, although it had entered on a bright channel between the great belt and a smaller one south of it. The satellite was thought to be less bright on its southern limb.

"At $9^{h.}$ $15^{m.}$, it had decreased in brightness so as to become hardly perceptible.

"At $9^{h.}$ $18^{m.}$ $15^{s.}$, my son, who was now observing, exclaimed quickly, — 'The dark spot is coming on; I now see the satellite; the dark spot is on the right hand, perhaps a little above!' On examination, I found the spot was quite distinct.

"$9^{h.}$ $21^{m.}$. The dark spot increases, and is now seen on the satellite.

"$9^{h.}$ $33^{m.}$. The spot has become conspicuous.

"At $9^{h.}$ $40^{m.}$, the diameter of it was measured with the spider-line micrometer, in the direction of the belts of Jupiter, and was found to be 0."50 by B_3, immediately after the angle of position of what was considered to be the longer axis = 170°.

"The following diameters were then measured in the first position:—

	h. m.	"	
At	9 44	0.71	by B_3.
	9 47	0.85	" B_1.
	9 55	1.10	" B_3.
	10 00	1.00	" B_1.
	10 02	0.99	" "

"$10^{h.}$ $5^{m.}$. It appears perfectly black and nearly round; tried different powers; it is best seen with 400; there are doubts of the spot being round, but could not decide on any other form.

"$10^{h.}$ $32^{m.}$ B_1 thinks it is not so black as it was.

"$10^{h.}$ $35^{m.}$. Satellite past the middle, and keeps in the bright channel.

"$11^{h.}$ $7^{m.}$. The satellite now appears black; it has accomplished three quarters of its journey across the disk.

"$11^{h.}$ $17^{m.}$. Spot dark as ever, perhaps darker. B_3 thinks it inclines to the south-following limb of the satellite.

"$11^{h.}$ $37^{m.}$. The satellite is seen broad, but not so dark; it is getting near the edge.

"$11^{h.}$ $52^{m.}$. Can just discern the spot, but the altitude is getting low; however, the seeing is remarkably good, at times, for so low an altitude. It is now doubtful whether the bright part of the satellite can be seen or not.

"$11^{h.}$ $58^{m.}$. Neither spot nor satellite is visible, absolutely.

"$12^{h.}$ $6^{m.}$. One half the satellite is seen as it passes off the disk; it is *bright*.

"$12^{h.}$ $12^{m.}$. The last external contact was observed by B_3, who noticed that the limb of Jupiter appeared flattened.

"$12^{h.}$ $21^{m.}$. The third satellite is now seen at a considerable distance from Jupiter, and the order of brightness is,—first, second, third. The fourth satellite is under eclipse.

"It is evident that the third satellite is not now one half the brightness of the second, which it far surpassed before the transit took place.

It has also diminished in apparent magnitude, and the light has changed from a strong yellowish-white to a dull bluish-gray color.

"The tabular order of the mean relative magnitudes of the satellites is, — third, fourth, first, second.

"One of the most remarkable features attending the progress of this phenomenon was the rapidity with which the change from bright to dark took place. At $9^{h.}$ $15^{m.}$ there was no indication of change, unless the apparent gradual fading of the light of the satellite is so considered, but which I should rather attribute to the increased amount of light reflected from Jupiter nearer this centre. At $9^{h.}$ $18^{m.}$ $30^{s.}$, when I again saw the satellite, the dark part had so increased as not to be mistaken for a moment, and my son represents the change as taking place almost instantaneously, not leaving a doubt from the first.

"The satellite was watched for some time after the transit, and it appeared to be *gradually* resuming its pristine brilliancy."

Mr. Mitchell read the subjoined account of a remarkable meteor, which was seen from Nantucket, on the 6th of March last.

"On the 7th of last month (March), 1848, while in Boston, I received a letter from my daughter, at Nantucket, stating that on the previous morning, at about half past two o'clock, a meteor of surpassing magnitude and brilliancy was seen by several persons, and its report was so loud that many individuals were awakened by it. With a view of eliciting information from other quarters, I requested the editor of the Evening Transcript to give publicity to the fact, simply as I have now stated it.

"On returning to Nantucket, so much was said of the magnitude and extreme brightness of the meteor, and of the loudness of the report, that I was induced to make a systematic investigation of the circumstances attending it, in view of the possibility that some of the fragments, or the undivided body itself, might have fallen upon the island.

"Among the witnesses of the phenomenon were two of the street watchmen, both intelligent men, who were situated, at the moment, 3,250 feet asunder, and in a direction from each other nearly at right angles with the direction of the meteor as first seen. With each of these gentlemen I went to the spot which they respectively occupied when they first saw it, and by the aid of buildings in the vicinity I

was able to ascertain, to tolerable satisfaction, the apparent direction of its motion, and its position when earliest seen. Taking afterwards, by means of a circumferenter, the difference of its apparent position at these extreme points, and assuming that the eyes of both observers were directed to it at the same moment, which is the more likely to be true, from the fact, that they were both facing the region occupied by the meteor, I found its parallax with this base to be 6° ; its direction from one being south 52½° east, and from the other south 46½° east, each at an estimated altitude of 30°.

"The report occurred ninety-two seconds after the entire extinction of the illumination, and after the meteor, without any appearance of separation, had reached the horizon.

"To obtain the measurement of this interval, I requested each watchman separately, and without the knowledge of the other, to move onward in his usual pace to the position at which he had arrived when the report was heard, and during this period, I noted the time by a chronometer ; and it is certainly remarkable, that by this rude method they differed from each other less than five seconds.

"All parties agree that the illumination was quite equal to that of a bright moon, giving to every visible object a frightful aspect; and also that the brilliancy of the meteor was extremely painful to the eye. Only two persons with whom I have conversed were so situated as to follow its course quite to the horizon, or near to the point of its contact with the earth. Those individuals testify, that it emitted no scintillations, but maintained a perfectly circular form through its whole course. The report is said to have been startling ; the rattling of windows and jarring of the houses are spoken of by many witnesses, every one noticing that, unlike the discharge of cannon or a peal of thunder, it was without reverberation. Some persons who were roused by the extreme light, but did not see the illumination, supposed it to have been the jar of an earthquake.

"Observers differ widely in estimating its apparent diameter, though they were requested to observe the moon as the standard of measurement. Some supposed it exceeded the moon ; others, and quite the greatest number, thought it less than the moon in apparent diameter, the lowest estimate being two thirds the disk of that luminary. I take twenty minutes to be the optical apparent diameter of the meteor; stripping this of all possible illusion arising from its dazzling brightness, I am persuaded that it subtended an angle of at least twelve minutes.

"From these data, rude and imperfect as they necessarily are, I conclude that a mass of matter nearly spherical, one hundred and five feet in diameter, entered the earth's atmosphere in a direction from west to east, passed the town of Nantucket, with great obliquity, at the distance of nearly 6 miles, and impinged upon the earth's surface $19\frac{3}{4}$ miles east of the town, in the Atlantic ocean, 14 miles east of the island.

"Whether this mass was solid or fluid is uncertain; and yet we can hardly suppose that a gaseous body, when rushing through the atmosphere, would have maintained so constantly its globular form, as indicated by its circular appearance; nor are we prepared to admit, that one liquid mass impinging on another would produce a report, which, at the distance of twenty miles, would be so sharp and jarring, that many persons should think it an earthquake. My own opinion is, formed from evidence of which the foregoing is a mere brief, that a solid mass of matter, of no inconsiderable size, fell upon the earth on that occasion."

Professor Peirce communicated the following letter from Mr. Sears C. Walker to himself.

"*Washington, D. C., March 6th*, 1848.

"I have computed the small corrections of the elliptic elements of the planet Neptune, which you were so kind as to communicate to the American Academy in December last.

$$\begin{aligned} d\pi &= -1^\circ\ 8'\ 56''.43. \\ d\Omega &= -\qquad 14.22. \\ di &= -\qquad 0.57. \\ de &= +0.000014205. \\ d\mu &= \ 0''.0. \\ dM &= +47''.84. \\ dT &= \ 0.0^{y}. \end{aligned}$$

These corrections, applied to the first approximation, furnish the second approximation towards the elliptic elements of Neptune.

$$\left.\begin{aligned} \pi &= 47^\circ\ 12'\ 6''.50 \\ \Omega &= 130\ \ 4\ \ 20.81 \end{aligned}\right\}\text{ mean equinox, Jan. 1, 1847.}$$

$$\begin{aligned} i &= 1\ \ 46\ \ 58.97. \\ e &= 0.00871946. \\ \mu &= 21.''55448. \\ M &= 328^\circ\ 32'\ 44''.20,\text{ mean noon, Greenwich, Jan. 1, 1847.} \\ T &= 164.6181\text{ tropical years.} \end{aligned}$$

"The ephemeris from these elements II., after applying the values of the perturbations δv and δr, from your paper of Dec. 17th, 1847, before referred to, requires, in order to conform to observation, the following corrections in R. A. and Dec.

	Obs. — Eph. $\Delta A_{\prime}$	Obs. — Eph. $\Delta D_{\prime}$
1795, May 8,	$+ 0''.29$	$+ 0''.79$
" " 10,	$+ 1.18$	$+ 0.31$
1846, Sept. 26,	$- 0.21$	$+ 0.55$
" Nov. 7,	$- 0.10$	$+ 0.63$
1847, April 6,	$+ 0.42$	$- 0.18$
" Aug. 22,	$- 0.66$	$+ 0.23$
" Nov. 14,	$- 0.70$	$+ 0.90$

The agreement is so close, that I shall not attempt any farther approximation towards the true elements till after the next opposition has been observed. For the Lalande observations, I have used Mauvais's places from the *Comtes Rendus.* They furnish internal evidence of their excellence, by their perfect representation of the two days' motion of the planet.

"Yours, truly and respectfully,

"SEARS C. WALKER."

Professor Peirce communicated a memoir from Mr. G. P. Bond, on the direct computation of the orbit of a comet, from three observations of its right ascension and declination, and remarked upon the clear and simple views which Mr. Bond had taken of the subject.

Professor Peirce announced that he had completed his investigation into the action of Neptune upon Uranus, and had ascertained that this planet will completely account for the observed irregularities in the motions of Uranus, provided that mass of Neptune is adopted which is derived from Mr. Bond's observations of Lassell's satellite.

"The following table exhibits the residual differences between the observed and computed longitudes of Uranus, from which it appears that, with the mass of Neptune deduced from Mr. Bond's observations of Lassell's satellite, the theory of Uranus is now perfect, and the motions of this planet do not indicate that there is any other unknown source of perturbation. It appears, moreover, that the mass which is

derived from Mr. Bond's observations is far more satisfactory than that which M. Struve has obtained from his own observations.

"The fifth and sixth columns of the table contain the small discrepancies between theory and observation which would have remained after making allowance for the action of the hypothetical planets of Adams and Leverrier; and their comparison with the second column shows that the observation of 1690 was not sufficiently well represented by the theories which resulted in the discovery of Neptune.

"The seventh column contains the residual defects of the best theory of Uranus, which is independent of the action of an external planet, and is the true basis of the researches of Adams and Leverrier. This theory was constructed by Leverrier from all the modern observations, and the discrepancy between theory and observation was the final proof that Uranus was subjected to some unknown cause of perturbation. The time t is the number of Julian years from Jan. 1, 1850. The longitude of the perihelion is denoted by ϖ, with the symbol of the planet subjacent.

"*Residual Differences between the Theoretical and Observed Longitudes of Uranus, from the Theories of Peirce, Leverrier, and Adams.*

	Date.	From Peirce's Theory of Neptune, adopting for its mass, — that deduced by Peirce from Bond's observations of Lassell's satellite $=\frac{1}{19840}$	that deduced by Peirce from Bond's and Lassell's observations combined $=\frac{1}{18780}$	that deduced by Struve from his own observations of the satellite $=\frac{1}{14496}$	From Leverrier's original theory, with his best orbit of hypothetical planet, of which the mass $=\frac{1}{9322}$	From Adams's original theory, with his 2d hypothetical planet, of which the mass $=\frac{1}{6666}$	From Leverrier's best orbit of Uranus for the modern observations, without any external planet.
	1845	−0″.9	−1″.2	−2″.8	−0″.3		+6″.5
	1840	−1.1	−1.3	−1.3	+2.2	+1″.3	+0.7
	1835	+2.0	+2.4	+3.9	−0.8	−1.2	−4.5
	1829	+0.8	+1.3	+2.5	−2.2	+2.0	−7.8
	1824	−2.0	−1.9	−1.6	−5.4	+1.7	−7.6
	1819	+1.0	+0.7	+0.9	+0.4	−2.2	+3.8
	1813	−0.3	+1.1	−2.3	−0.9	−1.0	+4.5
	1808	−0.4	−0.6	−1.3	+0.8	0.0	+3.8
	1803	+0.8	+1.2	+3.2	+0.8	+1.6	−3.4
	1797	+0.3	+0.8	+3.3	−1.0	−0.5	−6.7
	1792	+0.3	+0.5	+1.6	+0.3	−1.1	−7.8
	1787	−0.5	−1.2	−4.7	−1.2	−0.2	+2.0
	1782	−3.0	−5.6	−18.3	+2.3	0.0	+20.5
Ancient.	1769	−6.0	−16.0	−67.0	+3.7	+1.8	+123.3
	1756	+4.0	−12.7	−102.4	−4.0	−4.0	+230.9
	1715	+8.7	+10.0	−99.6	+5.5	−6.6	+279.6
	1690	+0.8	+13.0	−124.7	−19.9	+50.0	+289.0

"This table was computed from the following formulæ for the perturbations of the mean longitude and radius vector of Uranus, which are arranged in a form similar to that proposed by Leverrier, and adopted in his theory of Mercury. The mean longitude of each planet is denoted by the appropriate symbol of the planet. The elements of Neptune which are adopted are those last given by Mr. Walker, and the mass of Neptune which is introduced into the formulæ is $\frac{1}{20000}$th of the sun's mass, for which any other mass is readily substituted by simple multiplication.

"The perturbation of the mean longitude $= \delta v =$

$$
\begin{array}{lll}
- 33''82 \text{ sin. } (\text{♅} - \text{♆}) & - 0''02 \text{ cos. } (\text{♅} - \text{♆}) \\
- 818.98 \text{ sin. } 2\,(\text{♅} - \text{♆}) & - 0.99 \text{ cos. } 2\,(\text{♅} - \text{♆}) \\
+ 14.10 \text{ sin. } 3\,(\text{♅} - \text{♆}) & - 0.01 \text{ cos. } 3\,(\text{♅} - \text{♆}) \\
+ 3.93 \text{ sin. } 4\,(\text{♅} - \text{♆}) & + 0.18 \text{ cos. } 4\,(\text{♅} - \text{♆}) \\
+ 1.05 \text{ sin. } 5\,(\text{♅} - \text{♆}) & - 0.01 \text{ cos. } 5\,(\text{♅} - \text{♆}) \\
+ 0.43 \text{ sin. } 6\,(\text{♅} - \text{♆}) & + 0.20 \text{ sin. } 7\,(\text{♅} - \text{♆}) \\
+ 0.09 \text{ sin. } 8\,(\text{♅} - \text{♆}) & + 0.04 \text{ sin. } 9\,(\text{♅} - \text{♆}) \\
+ 0.02 \text{ sin. } 10\,(\text{♅} - \text{♆}) & + 0.01 \text{ sin. } 11\,(\text{♅} - \text{♆}) \\
+ 0.01 \text{ sin. } 12\,(\text{♅} - \text{♆}) & + A
\end{array}
$$

$$
\begin{array}{l}
+ 0''00434\, t \text{ sin. } (\text{♅} - \varpi_{\text{♅}}) - 0''035411\, t \text{ cos. } (\text{♅} - \varpi_{\text{♅}}) \\
+ k \text{ sin. } (\text{♅} + \theta - \varpi_{\text{♅}}) \\
+ k_1 \text{ sin. } (2\,\text{♅} + \theta_1 - 2\,\varpi_{\text{♅}}) \\
+ k_2 \text{ sin. } (\text{♅} + \theta_2 - \varpi_{\text{♅}})
\end{array}
$$

in which

$$
\begin{array}{rll}
A = & 2692''74 \text{ sin. } (2\,\text{♆} - \text{♅} - \varpi_{\text{♅}}) & + 149''76 \text{ cos. } (2\,\text{♆} - \text{♅} - \varpi_{\text{♅}}) \\
+ & 106.80 \text{ sin. } (4\,\text{♆} - 2\,\text{♅} - 2\,\varpi_{\text{♅}}) & - 43.08 \text{ cos. } (4\,\text{♆} - 2\,\text{♅} - 2\,\varpi_{\text{♅}}) \\
- & 6.09 \text{ sin. } (6\,\text{♆} - 3\,\text{♅} - 3\,\varpi_{\text{♅}}) & + 4.20 \text{ cos. } (6\,\text{♆} - 3\,\text{♅} - 3\,\varpi_{\text{♅}}) \\
+ & 0.48 \text{ sin. } (8\,\text{♆} - 4\,\text{♅} - 4\,\varpi_{\text{♅}}) & + 0.47 \text{ cos. } (8\,\text{♆} - 4\,\text{♅} - 4\,\varpi_{\text{♅}}) \\
- & 0.06 \text{ sin. } (10\,\text{♆} - 5\,\text{♅} - 5\,\varpi_{\text{♅}}) & + 0.01 \text{ cos. } (10\,\text{♆} - 5\,\text{♅} - 5\,\varpi_{\text{♅}})
\end{array}
$$

$$
\begin{array}{rll}
k \text{ sin. } \theta = & - 2''58 \text{ sin. } (\text{♅} - \text{♆}) & - 0''44 \text{ cos. } (\text{♅} - \text{♆}) \\
& - 11.35 \text{ sin. } 2\,(\text{♅} - \text{♆}) & - 0.02 \text{ cos. } 2\,(\text{♅} - \text{♆}) \\
& + 18.27 \text{ sin. } 3\,(\text{♅} - \text{♆}) & + 3.68 \text{ cos. } 3\,(\text{♅} - \text{♆}) \\
& + 66.38 \text{ sin. } 4\,(\text{♅} - \text{♆}) & + 13.50 \text{ cos. } 4\,(\text{♅} - \text{♆}) \\
& - 2.74 \text{ sin. } 5\,(\text{♅} - \text{♆}) & - 0.56 \text{ cos. } 5\,(\text{♅} - \text{♆}) \\
& - 0.78 \text{ sin. } 6\,(\text{♅} - \text{♆}) & - 0.17 \text{ cos. } 6\,(\text{♅} - \text{♆}) \\
& - 0.26 \text{ sin. } 7\,(\text{♅} - \text{♆}) & - 0.05 \text{ cos. } 7\,(\text{♅} - \text{♆})
\end{array}
$$

$$
\begin{aligned}
&- 0''.10 \sin. 8\,(♆ - ♅) - 0''.03 \cos. 8\,(♆ - ♅)\\
&- 0.04 \sin. 9\,(♆ - ♅) - 0.01 \cos. 9\,(♆ - ♅)\\
&- 0.02 \sin. 10\,(♆ - ♅) - 0.01 \cos. 10\,(♆ - ♅)\\
&- 0.02 \sin. 11\,(♆ - ♅) - 0.01 \cos. 11\,(♆ - ♅)\\
&- 0.01 \sin. 12\,(♆ - ♅) - 0.01 \sin. 13\,(♆ - ♅)
\end{aligned}
$$

$$
\begin{aligned}
k \cos. \theta = &- 0''.42 \sin. (♆ - ♅) + 1''.44 \cos. (♆ - ♅)\\
&+ 0.02 \sin. 2\,(♆ - ♅) - 11.35 \cos. 2\,(♆ - ♅)\\
&+ 3.68 \sin. 3\,(♆ - ♅) - 17.71 \cos. 3\,(♆ - ♅)\\
&+ 13.42 \sin. 4\,(♆ - ♅) - 66.18 \cos. 4\,(♆ - ♅)\\
&- 0.56 \sin. 5\,(♆ - ♅) + 2.84 \cos. 5\,(♆ - ♅)\\
&- 0.17 \sin. 6\,(♆ - ♅) + 0.82 \cos. 6\,(♆ - ♅)\\
&- 0.05 \sin. 7\,(♆ - ♅) + 0.28 \cos. 7\,(♆ - ♅)\\
&- 0.03 \sin. 8\,(♆ - ♅) + 0.13 \cos. 8\,(♆ - ♅)\\
&- 0.01 \sin. 9\,(♆ - ♅) + 0.06 \cos. 9\,(♆ - ♅)\\
&- 0.01 \sin. 10\,(♆ - ♅) + 0.04 \cos. 10\,(♆ - ♅)\\
&- 0.01 \sin. 11\,(♆ - ♅) + 0.02 \cos. 11\,(♆ - ♅)\\
&+ 0.01 \cos. 12\,(♆ - ♅) + 0.01 \cos. 13\,(♆ - ♅)
\end{aligned}
$$

$$
\begin{aligned}
k_1 \sin. \theta_1 = &+ 0''.41 \sin. 2\,(♆ - ♅) - 0''.65 \cos. 2\,(♆ - ♅)\\
&- 0.49 \sin. 3\,(♆ - ♅) - 0.13 \cos. 3\,(♆ - ♅)\\
&- 1.07 \sin. 5\,(♆ - ♅) - 0.48 \cos. 5\,(♆ - ♅)\\
&- 5.81 \sin. 6\,(♆ - ♅) - 2.50 \cos. 6\,(♆ - ♅)\\
&- 0.10 \sin. 7\,(♆ - ♅) - 0.06 \cos. 7\,(♆ - ♅)\\
&- 0.06 \sin. 8\,(♆ - ♅) - 0.03 \cos. 8\,(♆ - ♅)\\
&- 0.03 \sin. 9\,(♆ - ♅) - 0.02 \cos. 9\,(♆ - ♅)\\
&- 0.01 \sin. 10\,(♆ - ♅) - 0.01 \cos. 10\,(♆ - ♅)\\
&- 0.01 \sin. 11\,(♆ - ♅)
\end{aligned}
$$

$$
\begin{aligned}
k_1 \cos. \theta_1 = &- 0''.65 \sin. 2\,(♆ - ♅) - 0''.86 \cos. 2\,(♆ - ♅)\\
&- 0.13 \sin. 3\,(♆ - ♅) + 0.49 \cos. 3\,(♆ - ♅)\\
&- 0.48 \sin. 5\,(♆ - ♅) + 1.07 \cos. 5\,(♆ - ♅)\\
&- 2.50 \sin. 6\,(♆ - ♅) + 5.81 \cos. 6\,(♆ - ♅)\\
&- 0.06 \sin. 7\,(♆ - ♅) + 0.10 \cos. 7\,(♆ - ♅)\\
&- 0.03 \sin. 8\,(♆ - ♅) + 0.06 \cos. 8\,(♆ - ♅)\\
&- 0.02 \sin. 9\,(♆ - ♅) + 0.03 \cos. 9\,(♆ - ♅)\\
&- 0.01 \sin. 10\,(♆ - ♅) + 0.01 \cos. 10\,(♆ - ♅)\\
&+ 0.01 \cos. 11\,(♆ - ♅)
\end{aligned}
$$

$$\begin{aligned}
k_2 \sin.\theta_2 = {} & +0''.71 \sin.\ (4\,\text{♆} - 2\,\text{♅} - 2\,\varpi_{\text{♅}}) - 0''.01 \cos.\ (4\,\text{♆} - 2\,\text{♅} - 2\,\varpi_{\text{♅}}) \\
& +0.38 \sin.\ (8\,\text{♆} - 4\,\text{♅} - 4\,\varpi_{\text{♅}}) + 0.54 \cos.\ (8\,\text{♆} - 4\,\text{♅} - 4\,\varpi_{\text{♅}}) \\
& -0.03 \sin.\ (10\,\text{♆} - 5\,\text{♅} - 5\,\varpi_{\text{♅}}) - 0.06 \cos.\ (10\,\text{♆} - 5\,\text{♅} - 5\,\varpi_{\text{♅}})
\end{aligned}$$

$$\begin{aligned}
k_2 \cos.\theta_2 = {} & +0''.01 \sin.\ (4\,\text{♆} - 2\,\text{♅} - 2\,\varpi_{\text{♅}}) + 0''.71 \cos.\ (4\,\text{♆} - 2\,\text{♅} - 2\,\varpi_{\text{♅}}) \\
& -0.54 \sin.\ (8\,\text{♆} - 4\,\text{♅} - 4\,\varpi_{\text{♅}}) + 0.38 \cos.\ (8\,\text{♆} - 4\,\text{♅} - 4\,\varpi_{\text{♅}}) \\
& +0.06 \sin.\ (10\,\text{♆} - 5\,\text{♅} - 5\,\varpi_{\text{♅}}) - 0.03 \cos.\ (10\,\text{♆} - 5\,\text{♅} - 5\,\varpi_{\text{♅}})
\end{aligned}$$

The perturbation of the radius vector $= \delta r =$

$$\begin{aligned}
& 0.000851 \cos.\ (\text{♅} - \text{♆}) \\
& +0.031823 \cos.\ 2\,(\text{♅} - \text{♆}) - 0.000036 \sin.\ 2\,(\text{♅} - \text{♆}) \\
& -0.000825 \cos.\ 3\,(\text{♅} - \text{♆}) \\
& -0.000338 \cos.\ 4\,(\text{♅} - \text{♆}) + 0.000026 \sin.\ 4\,(\text{♅} - \text{♆}) \\
& -0.000069 \cos.\ 5\,(\text{♅} - \text{♆}) - 0.000029 \cos.\ 6\,(\text{♅} - \text{♆}) \\
& -0.000013 \cos.\ 7\,(\text{♅} - \text{♆}) - 0.000007 \cos.\ 8\,(\text{♅} - \text{♆}) \\
& -0.000003 \cos.\ 9\,(\text{♅} - \text{♆}) - 0.000002 \cos.\ 10\,(\text{♅} - \text{♆}) \\
& -0.000001 \cos.\ 11\,(\text{♅} - \text{♆}) - 0.000001 \cos.\ 12\,(\text{♅} - \text{♆}) \\
& -0.000001565\, t \sin.\ (\text{♅} - \text{♆}) \\
& -0.000000114\, t \cos.\ (\text{♅} - \text{♆}) \\
& +B - 0.000232 \\
& +k' \cos.\ (\text{♅} - \theta' - \varpi_{\text{♅}}) \\
& +k'_1 \cos.\ (2\,\text{♅} - \theta'_1 - 2\,\varpi_{\text{♅}}) \\
& +k'_2 \cos.\ (\text{♅} - \theta'_2 - \varpi_{\text{♅}})
\end{aligned}$$

in which

$$\begin{aligned}
B = {} & +0.000195 \sin.\ (2\,\text{♆} - \text{♅} - \varpi_{\text{♅}}) + 0.001684 \cos.\ (2\,\text{♆} - \text{♅} - \varpi_{\text{♅}}) \\
& -0.000089 \sin.\ (4\,\text{♆} - 2\,\text{♅} - 2\,\varpi_{\text{♅}}) - 0.000151 \cos.\ (4\,\text{♆} - 2\,\text{♅} - 2\,\varpi_{\text{♅}}) \\
& +0.000012 \sin.\ (6\,\text{♆} - 3\,\text{♅} - 3\,\varpi_{\text{♅}}) + 0.000013 \cos.\ (6\,\text{♆} - 3\,\text{♅} - 3\,\varpi_{\text{♅}}) \\
& -0.000002 \sin.\ (8\,\text{♆} - 4\,\text{♅} - 4\,\varpi_{\text{♅}}) - 0.000003 \cos.\ (8\,\text{♆} - 4\,\text{♅} - 4\,\varpi_{\text{♅}})
\end{aligned}$$

$$\begin{aligned}
k' \cos.\theta' = {} & +0.000009 \sin.\ (\text{♅} - \text{♆}) - 0.000039 \cos.\ (\text{♅} - \text{♆}) \\
& +0.000096 \sin.\ 3\,(\text{♅} - \text{♆}) - 0\,000477 \cos.\ 3\,(\text{♅} - \text{♆}) \\
& -0.000001 \sin.\ 4\,(\text{♅} - \text{♆}) - 0.000012 \cos.\ 4\,(\text{♅} - \text{♆}) \\
& -0.000033 \sin.\ 5\,(\text{♅} - \text{♆}) + 0.000158 \cos.\ 5\,(\text{♅} - \text{♆}) \\
& -0.000014 \sin.\ 6\,(\text{♅} - \text{♆}) + 0.000047 \cos.\ 6\,(\text{♅} - \text{♆}) \\
& -0.000004 \sin.\ 7\,(\text{♅} - \text{♆}) + 0.000018 \cos.\ 7\,(\text{♅} - \text{♆}) \\
& -0.000002 \sin.\ 8\,(\text{♅} - \text{♆}) + 0.000009 \cos.\ 8\,(\text{♅} - \text{♆}) \\
& -0.000001 \sin.\ 9\,(\text{♅} - \text{♆}) + 0.000003 \cos.\ 9\,(\text{♅} - \text{♆}) \\
& -0.000001 \sin.\ 10\,(\text{♅} - \text{♆}) + 0\,000002 \cos.\ 10\,(\text{♅} - \text{♆}) \\
& +0.000001 \cos.\ 11\,(\text{♅} - \text{♆}) + 0.000001 \cos.\ 12\,(\text{♅} - \text{♆})
\end{aligned}$$

$$
\begin{aligned}
k' \sin.\theta' = & -0.000219 \sin.(\text{♅}-\text{♆}) && -0.000011 \cos.(\text{♅}-\text{♆}) \\
& -0.000399 \sin.\ 3(\text{♅}-\text{♆}) && -0.000096 \cos.\ 3(\text{♅}-\text{♆}) \\
& +0.000012 \sin.\ 4(\text{♅}-\text{♆}) && -0.000001 \cos.\ 4(\text{♅}-\text{♆}) \\
& +0.000170 \sin.\ 5(\text{♅}-\text{♆}) && +0.000033 \cos.\ 5(\text{♅}-\text{♆}) \\
& +0.000053 \sin.\ 6(\text{♅}-\text{♆}) && +0.000014 \cos.\ 6(\text{♅}-\text{♆}) \\
& +0.000022 \sin.\ 7(\text{♅}-\text{♆}) && +0.000004 \cos.\ 7(\text{♅}-\text{♆}) \\
& +0.000011 \sin.\ 8(\text{♅}-\text{♆}) && +0.000002 \cos.\ 8(\text{♅}-\text{♆}) \\
& +0.000005 \sin.\ 9(\text{♅}-\text{♆}) && +0.000001 \cos.\ 9(\text{♅}-\text{♆}) \\
& +0.000002 \sin.\ 10(\text{♅}-\text{♆}) && +0.000001 \cos.\ 10(\text{♅}-\text{♆}) \\
& +0.000001 \sin.\ 11(\text{♅}-\text{♆}) && +0.000001 \sin.\ 12(\text{♅}-\text{♆})
\end{aligned}
$$

$$
\begin{aligned}
k'_1 \cos.\theta'_1 = & -0.000002 \sin.\ 3(\text{♅}-\text{♆}) && -0.000001 \cos.\ 3(\text{♅}-\text{♆}) \\
& -0.000009 \sin.\ 5(\text{♅}-\text{♆}) && +0.000027 \cos.\ 5(\text{♅}-\text{♆}) \\
& -0.000005 \sin.\ 7(\text{♅}-\text{♆}) && +0.000012 \cos.\ 7(\text{♅}-\text{♆}) \\
& -0.000002 \sin.\ 9(\text{♅}-\text{♆}) && +0.000006 \cos.\ 9(\text{♅}-\text{♆}) \\
& -0.000001 \sin.\ 10(\text{♅}-\text{♆}) && +0.000004 \cos.\ 10(\text{♅}-\text{♆}) \\
& && +0.000003 \cos.\ 11(\text{♅}-\text{♆}) \\
& +0.000001 \sin.(2\text{♆}-\text{♅}-\varpi_{\text{♅}}) && +0.001854 \cos.(2\text{♆}-\text{♅}-\varpi_{\text{♅}}) \\
& && -0.000009 \cos.(4\text{♆}-2\text{♅}-2\varpi_{\text{♅}}) \\
& -0.000004 \sin.(8\text{♆}-4\text{♅}-4\varpi_{\text{♅}}) && +0.000009 \cos.(8\text{♆}-4\text{♅}-4\varpi_{\text{♅}})
\end{aligned}
$$

$$
\begin{aligned}
k'_1 \sin.\theta'_1 = & +0.000001 \sin.\ 3(\text{♅}-\text{♆}) && -0.000002 \cos.\ 3(\text{♅}-\text{♆}) \\
& +0.000027 \sin.\ 5(\text{♅}-\text{♆}) && +0.000009 \cos.\ 5(\text{♅}-\text{♆}) \\
& +0.000012 \sin.\ 7(\text{♅}-\text{♆}) && +0.000005 \cos.\ 7(\text{♅}-\text{♆}) \\
& +0.000006 \sin.\ 9(\text{♅}-\text{♆}) && +0.000002 \cos.\ 9(\text{♅}-\text{♆}) \\
& +0.000004 \sin.10(\text{♅}-\text{♆}) && +0.000001 \cos.\ 10(\text{♅}-\text{♆}) \\
& +0.000003 \sin.11(\text{♅}-\text{♆}) && \\
& +0.001324 \sin.(2\text{♆}-\text{♅}-\varpi_{\text{♅}}) && +0.000027 \cos.(2\text{♆}-\text{♅}-\varpi_{\text{♅}}) \\
& +0.000009 \sin.(4\text{♆}-2\text{♅}-2\varpi_{\text{♅}}) && \\
& +0.000009 \sin.(8\text{♆}-4\text{♅}-4\varpi_{\text{♅}}) && +0.000004 \cos.(8\text{♆}-4\text{♅}-4\varpi_{\text{♅}})
\end{aligned}
$$

$$
\begin{aligned}
k'_2 \cos.\theta'_2 = & +0.000253 \sin.(2\text{♆}-\text{♅}-\varpi_{\text{♅}}) && +0.005710 \cos.(2\text{♆}-\text{♅}-\varpi_{\text{♅}}) \\
& -0.000660 \sin.(4\text{♆}-2\text{♅}-2\varpi_{\text{♅}}) && -0.002992 \cos.(4\text{♆}-2\text{♅}-2\varpi_{\text{♅}}) \\
& +0.000105 \sin.(6\text{♆}-3\text{♅}-3\varpi_{\text{♅}}) && +0.000282 \cos.(6\text{♆}-3\text{♅}-3\varpi_{\text{♅}}) \\
& -0.000017 \sin.(8\text{♆}-4\text{♅}-4\varpi_{\text{♅}}) && -0.000025 \cos.(8\text{♆}-4\text{♅}-4\varpi_{\text{♅}}) \\
& +0.000002 \sin.(10\text{♆}-5\text{♅}-5\varpi_{\text{♅}}) && +0.000003 \cos.(10\text{♆}-5\text{♅}-5\varpi_{\text{♅}})
\end{aligned}
$$

$$
\begin{aligned}
k'_2 \sin.\theta'_2 = & -0.005710 \sin.(2\text{♆}-\text{♅}-\varpi_{\text{♅}}) && +0.000253 \cos.(2\text{♆}-\text{♅}-\varpi_{\text{♅}}) \\
& -0.002520 \sin.(4\text{♆}-2\text{♅}-2\varpi_{\text{♅}}) && +0.000558 \cos.(4\text{♆}-2\text{♅}-2\varpi_{\text{♅}}) \\
& +0.000254 \sin.(6\text{♆}-3\text{♅}-3\varpi_{\text{♅}}) && -0.000085 \cos.(6\text{♆}-3\text{♅}-3\varpi_{\text{♅}}) \\
& -0.000025 \sin.(8\text{♆}-4\text{♅}-4\varpi_{\text{♅}}) && +0.000017 \cos.(8\text{♆}-4\text{♅}-4\varpi_{\text{♅}}) \\
& +0.000003 \sin.(10\text{♆}-5\text{♅}-5\varpi_{\text{♅}}) && -0.000002 \cos.(10\text{♆}-5\text{♅}-5\varpi_{\text{♅}})
\end{aligned}
$$

Mr. Pierce remarked that his original views were unchanged in regard to the importance to be attached to the vast discrepancies between the predicted and observed orbits of the planet which disturbs the motions of Uranus.

" Neptune is not the planet designated by geometry, although it is a perfect solution of the problem which analysis had undertaken to investigate, and had really solved, but in a form radically different from the actual solution of nature. This is not a personal question; it is certainly not one in which the reputations of Adams and Leverrier are concerned. The accuracy of their investigations is not assailed; but it is expressly admitted that they announced the correct results of most profound analytical researches.

" The fair consideration of this question cannot be made without recalling the true office and position of geometry in science, which alone entitles it to the appellation of the key to the physical world. Mathematics is the science of exact measurement; accuracy is its sole aim and object, and it is this which places it in harmony with a creation, which is subject to perfect law and undeviating order. An inaccurate result cannot be a geometrical one; a result, inaccurate beyond certain well-defined limits, does not belong to the exact science; an inconsistency, which exceeds a certain amount, may not be neglected by him who deals with nothing but *more or less*, without disturbing the very foundations of his faith.

"The geometrical statement was distinctly made, that the planet which disturbed Uranus could not be at a less mean distance from the sun than thirty-five times the earth's mean distance from the sun; that is, that no planet which was within this distance could cause the observed irregularities in the motions of Uranus. Neptune's mean distance from the sun is only thirty times the earth's mean distance, and yet Neptune does account for the perturbations of Uranus. It is five hundred millions of miles nearer the sun than it was distinctly stated by geometry that it possibly could be, in order to be capable of producing the effect which it actually does produce. The spirit of mathematical accuracy cannot be supposed to be sufficiently elastic to embrace so great an inconsistency, amounting to one sixth part of Neptune's distance from the sun, and to one half of the distance of his orbit from that of Uranus.

" Whence comes this enormous difference between the theoretical

and observed planets? Had it been quite small, it might have been regarded as an excusable numerical error. Had it even amounted to once or twice the radius of the earth's orbit, it might have been deemed an error, although it would then have been a grievous one, and would have seriously marred the beauty of the result. But as it is, it cannot be assumed to be a mere error, without admitting that such an one radically vitiates the whole theory. Whoever adopts this opinion, be it the author of the theory himself, is bound to show where the error is, and how far it extends. Such an opinion has never been advanced by me, and I am not responsible for it. I admit, however, that I have not fully investigated this point, but maintain that the profound geometry of M. Leverrier is not to be set aside without proof, or even argument. M. Leverrier found that the planet which would best account for the disturbed motion of Uranus was at the mean distance 36 from the sun; and that, by increasing or decreasing the mean distance of the hypothetical disturber, the want of coincidence between the observed and computed motions of Uranus increased until, at the mean distances of 38 on the increase and 35 on the decrease, the residual differences between theory and observation became so great as to be wholly inadmissible. He therefore came to the natural conclusion, from such a result, that the mean distance of the required planet from the sun could not be less than 35, or more than 38; and he contented himself with this conclusion, without extending his inquiries to still smaller mean distances; and any facts in regard to these inner distances which are *at variance with this result* are certainly not to be included under his theory. I have confined my remarks to M. Leverrier's researches, but nothing in Mr. Adams's less comprehensive investigations, in which there is no attempt to ascertain the limits, is opposed to these conclusions.

"It has been intimated, that too rigorous an agreement with observation was insisted upon in the original inquiries, and that the limits might have been extended to include Neptune, by a more liberal concession to other unknown planets, or to an error in the mass of Saturn. The inspection of the preceding table completely refutes such a suggestion, for it now appears that Neptune satisfies the observations of Uranus more perfectly than the best planet of previous theory. If Leverrier was, as I have supposed, correct in his former computations, he must have found by extending them, that, although the action of his hypothetical planet agreed less perfectly with observation by the

contraction of the radius of its orbit from 36 to 35, and that this disagreement would have still farther increased by a still farther contraction, there was a distance at which the disagreement ceased to increase, and would, on the contrary, begin to diminish, until at the distance 30 it would have vanished, and the disturbed motions of Uranus would have been wholly explained. But this singular change in the character of the disturbing force, if it really occurs, — and the only doubt in regard to it is derived from a supposed but unproved inaccuracy in Leverrier's investigations, — was excluded from the range of this geometer's investigations, and now that observation has led to its discovery, geometry cannot claim it as one of its predictions. The defect of the theory must be as frankly admitted as the more serious charge of error is boldly repelled.

"From some indistinct remarks which have been thrown out in regard to the mass of Neptune, which is not too small to be excluded from the limits of the theory, there seems to be an indisposition to confess this defect. But on turning to the original formulæ, it will be found that, although this small mass is not positively excluded, its adoption does not contribute to advance the claim of geometry upon the planet. It shows, on the contrary, most decisively, that the orbits of theory are all of them fundamentally different from those of Neptune. For the mean distance which corresponds to this mass in the theory is about 35½, and the eccentricity very much greater than in the best hypothetical orbit, while the discrepancy between the theoretical and observed action on Uranus is increased beyond the admitted limits.

"The case might safely rest there, but I desire to dwell upon the essential and radical difference between Neptune's action upon Uranus and that of the planets of theory. For this purpose, I will read an extract from a report made by me last September to the honorable committee of the Overseers of Harvard University who visited the Observatory.

"'The differences are not accidental, but inherent in the very nature of the case, while the points of resemblance are purely accidental. The solutions of Adams and Leverrier are perfectly correct for the assumption to which they are limited, and must be classed with the boldest and most brilliant attempts at analytical investigation, richly entitling their authors to all the *éclat* which has been lavished upon them, on account of the singular success with which they are thought to have been crowned. But their investigations are nevertheless wholly inap-

plicable to the theory of the mutual perturbations of Uranus and Neptune. The successive periods of conjunction and opposition, occurring at intervals of eighty-four years, that is, in about the time of revolution of Uranus, this planet is always at the same part of its orbit when it is most affected by the action of Neptune. The action of Neptune, consequently, assumes a fixed, permanent, undisturbed character, so that it can hardly be recognized as perturbation by the practical observer. It is far otherwise with the ordinary class of perturbations, where the place of greatest disturbance varies from point to point of the orbit; thus the place of greatest disturbance in the case of the theoretical planet would not have remained stationary, but have varied 80° upon the orbit of Uranus at each successive conjunction and opposition; so that the disturbance could not in this case be disguised to any great extent under the fixed laws of ordinary elliptic motion. In the case of Neptune, its action on Uranus is to be detected in the comparatively small differences between its character and that of an elliptic motion, and the difference between the influence at opposition and that at conjunction. In undertaking, therefore, anew the solution of the problem of the perturbations of Uranus, with the assumption of the actual period of Neptune, instead of that adopted in the former theories, I found at once that I could not profit by the previous researches of Adams and Leverrier. The problem now presented, instead of being of the usual character, assumed a differential form by the disguise of the primary perturbations under the aspect of elliptic motions, and the whole question now rested upon the secondary perturbations, which were comparatively unimportant in the previous theories.'

"There is a popular notion, which hardly deserves to be refuted before a scientific body, that the less distance of Neptune than the planet of geometry is compensated by its smaller mass, so that its action upon Uranus is the same with that which was predicted. But the fallacy of this view of the subject, which takes no cognizance of the chief difficulty of the problem arising from the unknown orbit of Uranus, is obvious enough from a simple inspection of the following table, in which no one can fail to perceive the difference between the actions of the two planets. The second column of this table, which comprises the action of the theoretical planet of Adams's second hypothesis, is copied from page 27 of Adams's memoir.

Date.	Action upon the longitude of Uranus of		Date.	Action upon the longitude of Uranus of	
	Adams's second hypothetical planet.	Neptune.		Adams's second hypothetical planet.	Neptune.
1845,		−34″.21	1797,	+16″.3	−18″.16
1840,	−11″.8	−33.77	1792,	+18.1	−19.67
1835,	−9.6	−32.35	1787,	+17.8	−22.10
1829,	−7.0	−29.64	1782,	+15.0	−25.04
1824,	−4.4	−26.84	1769,	+2.1	−32.25
1819,	−1.3	−23.93	1756,	−10.5	−34.31
1813,	+3.5	−20.72	1715,	+19.1	−18.45
1808,	+8.3	−18.81	1690,		−29.47
1803,	+12.3	−17.81			

"The difference in the action of the two planets is just balanced by the difference in the corrections of the elements of Uranus in the two theories. The corrections are given in the following table.

From the Theory of	Corrections in the Elements of the Orbit of Uranus of the				
	Mean Annual Motion.	Mean Distance.	Longitude of Epoch.	Eccentricity.	Longitude of Perihelion.
Adams's second hypothetical planet, . .	−0″.17846	+0.000148	−47″.62	+0.0001954	+1010″.5
Neptune with Peirce's computed mass, . .	−1.13560	+0.000942	+2575.4	−0.0003626	+8252.4
Neptune with Struve's mass, ...	−0.10387	+0.000086	+3511.7	−0.0005510	+11171.3

Mr. Bond communicated an account of his recent observations on the great nebula surrounding θ^1 Orionis; with drawings illustrating its appearance as seen through the Cambridge refractor. Of the resolution of parts of the nebula Mr. Bond expresses himself with confidence. Several new stars are added in the vicinity of the Trapezium, and the connection of the nebulous districts about *C* and *ι* Orionis with the great nebula conclusively established.

The paper was referred for publication in the Memoirs, as was also a communication from Mr. G. P. Bond, on "Some Methods of Computing the Ratio of the Distances of a Comet from the Earth."

Professor Agassiz made some remarks on the distinctive characters of the family of Cyprinoids or suckers, as distinguished from the Cyprinodons, and illustrated the remarkable difference

between the sexes, which had caused the establishment of a large number of nominal species.

DONATIONS TO THE LIBRARY,

FROM NOVEMBER, 1847, TO MAY, 1848.

Mémoires de la Société Ethnologique de Paris. Tom. I. and II. 1841 – 45. 8vo. From the Ethnological Society.

Bulletins de l'Académie Royale des Sciences de Bruxelles. Tom. XII. 2^{me} partie. Tom. XIII. and XIV. 1re partie. 8vo. Bruxelles, 1845 – 47. From the Brussels Academy.

Mémoires Couronnées et Mémoires de Savants Étrangers, publiés par l'Acad. Roy. des Sciences, etc., de Bruxelles. Tom. XIX., XX., XXI. 4to. 1845 – 46. From the Brussels Academy.

Nouveaux Mémoires de l'Acad. Royale des Sciences, etc., de Bruxelles. Tom. XIX. and XX. 4to. 1845 – 7. From the Brussels Academy.

Annales de l'Observatoire Royal de Bruxelles. Tom. V. 4to. 1846. From the Brussels Academy.

A. Quetelet. Observations de Phénomènes Périodiques. 4to. pamph. Bruxelles, 1846. From the Author.

A. Quetelet. Annuaire de l'Observatoire Royal de Bruxelles. Ann. 13^{me} et 14^{me}. 12mo. pamph. From the Brussels Observatory.

Annuaire de l'Académie Royale des Sciences, etc., de Bruxelles. Ann. 12^{me} et 13^{me}. 12mo. pamph. 1846 – 47. From the Academy.

Francis C. Gray. Prison Discipline in America. 8vo. pamph. Boston, 1847. From the Author.

Abhandlungen der Königlichen Preuss. Akademie der Wissenschaften zu Berlin. Jahr. 1845. 4to. 1847. From the Berlin Academy.

Monatsbericht der Königl. Preuss. Akad. Wissenschaften zu Berlin. Jan. – Dec. 1847. 8vo. From the Berlin Academy.

Flora Batava: Afbeelding en Beschrijzing van Nederlandsche Gewassen, door Jan Kops. Afgebuld on der opzigt van J. C. Sepp en Zoon. Aflev. 144, 145, 146. Amsterdam. From the Author.

Verhandlungen der Kaiserlich-Russischen Mineralogischen Gesellschaft zu St. Petersburg. Jahr. 1845 – 46. 8vo. pamph. 1846. From the Society.

Sir J. F. W. Herschel. Notice of the Life, Researches, and Discoveries of F. W. Bessel. From Rev. R. Sheepshanks.

Sir J. F. W. Herschel. Memoir of Francis Baily. 8vo. pamph. London, 1845. From Rev. R. Sheepshanks.

Portrait of Francis Baily, Esq. London, 1847. From Rev. R. Sheepshanks.

Usher Parsons, M. D. Physician for Ships. 3d ed. Boston, 1842. — Boylston Prize Essays. Boston, 1839. — Directions for making Anatomical Preparations. Philadelphia, 1834. — Remarks on Quarantine Systems. Boston, 1836. — Lecture on the Connection and Reciprocal Influence between the Brain and the Stomach. Providence, 1841. — Spinal Diseases: their Causes and Treatment. Boston, 1843. — 8vo. pamphlets. From the Author.

Frans. Ritter von Hauer. Die Cephalopoden des Salzkammergutes, aus der Sammlung seiner Durchlaucht des Fürsten von Metternich, etc. 4to. Vienna, 1846. From Prince Metternich.

J. D. Dana. On Certain Laws of Cohesive Attraction, as exemplified in a Crystal of Snow. 8vo. pamph. (Extr. from Amer. Jour. Sci.) From the Author.

Twenty-seventh Annual Report of the Mercantile Library Association of New York. New York, Jan. 1848. 8vo. From the Directors.

A. D. Bache. Report of Alexander D. Bache, Superintendent of the Coast Survey, showing the Progress of that Work for the Year ending October, 1847. From the Author.

Transactions of the American Philosophical Society. Vol. X., Part I. Philadelphia, 1847. From the Society.

Prof. Hausmann. Studien des Göttingischen Vereins Bergmannischer Freunde. 1833 – 44. 6 vols. 12mo. From the Author.

Geo. P. Marshall. Occultations Visible in the United States during 1848. Philadelphia, 1848. From the Author.

Magnetical and Meteorological Observations at St. Helena, during 1840, 1841, 1842, and 1843. Vol. I. 4to. London, 1847. From the British Government.

Prof. Silliman. American Journal of Science and Arts, for Jan., March, and May, 1848. From the Editors.

F. A. W. Miguel. Illustrationes Piperacearum. Rotterdam, 1844. From. Acad. Nat. Cur. Bonn and Breslau.

Abhandlungen der Phil.-Philol. Classe der Königl. Bayerschen Akad. der Wissenschaften. Band. III. and IV., Abth. 1, 2. 1840 – 46. — Historisch. Classe. Band. III. and IV., Abth. 1, 2. 1841 – 45. — 4to. Munich. From the Royal Bavarian Academy.

Gelehrte Anzeigen. (Bayersch. Akad.) Bände VI. - XXI. Munich, 1838 - 45. From the Royal Bavarian Academy.

Annual Report of the Trustees of the State Library, New York, 1848. 8vo. Albany. From the Trustees.

Bulletin de la Société Impériale des Naturalistes de Moscou. No. III. 8vo. Moscow, 1846. From the Society.

G. Fischer de Waldheim. Spicilegium Entomographiæ Rossicæ. (Extr. Bull. Imp. Soc. Natur. Mosc. 1844.) From the Author.

G. Fischer de Waldheim. Entomographie de la Russie. IV^me Vol. (Orthoptères). 4to. Moscow, 1846. From the Author.

G. Fischer de Waldheim. Notice sur quelques Sauriens Fossiles de Moscou. 4to. pamph. From the Author.

La Lega Italiana, Giornale Pol. Econ. Scien. e Litterario. Nos. 1 - 4. Genoa. From the Editor.

Map of the Mineral Lands adjacent to Lake Superior, ceded to the United States by the Treaty of 1842 with the Chippewas. From the War Department.

Joseph Leidy, M. D. Researches into the Comparative Structure of the Liver (with 3 plates). — On some Bodies in the Boa Constrictor resembling the Pacinian Corpuscules. — On a New Genus and Species of Fossil Ruminantia. — On a New Fossil Genus and Species of Ruminantoid Pachydermata. — 8vo. pamphlets. From the Author.

Ἀριστόβουλος. Universal Destruction of Aboriginal Races by Colonizing Nations, and eventually of the New Zealanders. London, 1847. pamph. From the Author.

Philosophical Transactions of the Royal Society of London for the year 1847. (Parts 1 and 2.) London, 1847. From the Royal Society.

Greenwich Astronomical Observations for 1845. London, 1847. From the Royal Society.

Prof. Loomis. Astronomical Observations at Hudson Observatory, Ohio. 3d Series. (Extr. from Trans. Amer. Phil. Soc., Vol. X.) From the Author.

Proceedings of the Academy of Natural Sciences. Philadelphia. Vol. III., 1846 - 47, and Vol. IV. to April, 1848. From the Academy.

Proceedings of the American Philosophical Society at Philadelphia. Vol. IV., for 1847. 8vo. From the Society.

Transactions of the Linnæan Society of London. Vol. XX., Part 2. 4to. — Proceedings of the Linnæan Society, Nos. 30 - 33. (1846 - 47.) 8vo. — From the Society.

Abhandlungen der Königlichen Gesellschaft der Wissenschaften zu Göttingen. Bände I. – III. (1843 – 47). 4to. From the Society.

Nachrichten von der Geog.-August. Universitat. und der Königl. Gesellschaft zu Göttingen. From the Royal Society of Göttingen.

Prof. Hausmann. Bemerkungen über Gyps und Karstenit. 4to. pamph. (Extr. Mem. Götting., Vol. III.) Göttingen, 1847.

Mémoires de la Société de Physique et d'Histoire Naturelle de Genève. Tom. XI. (1846 – 48.) 4to. Geneva. From the Society.

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